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Electrical World

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America

America generates more electrical energy than all the rest of the World, and has electrified its homes and industries on a scale that is the wonder of observers from other lands.

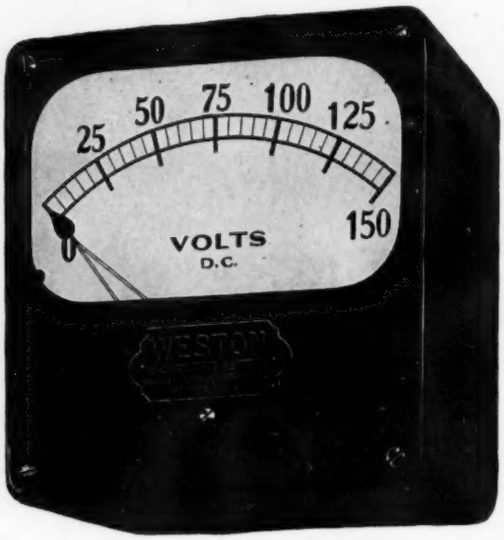
It is but natural that where the benefits of the uses of electricity are so greatly appreciated there would exist also the largest market for equipment for the generation and use of power. Brown, Boveri & Company, Ltd., having established associated companies for manufacturing electrical equipment of their design in practically every country in Europe, now enters the American market.

The Brown, Boveri story is on pages 37-48

Meeting with Approval the World Over— Space Savings on Switchboards

by WESTON RECTANGULARS

THE name of Weston is indelibly associated with the progress of electricity and has become synonymous with the utmost in accurate and dependable indicating instruments.



To that supremacy in precision and durability has been added supremacy in switchboard efficiency in the new line of modern rectangular case A. C. Ammeters, Voltmeters, Wattmeters, single and polyphase Wattmeters, Reactive Component Meters, Frequency Meters, Power Factor Meters and Triplex Ammeters; and D. C. Voltmeters and Ammeters.

Great space economy, greater scale legibility, and better accessibility for maintenance characterize the new Weston line. They are the modern instruments for modern switchboards, designed by modern engineers for modern power stations.

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WESTON ELECTRICAL INSTRUMENT CORPORATION
13 Weston Avenue, NEWARK, N. J.

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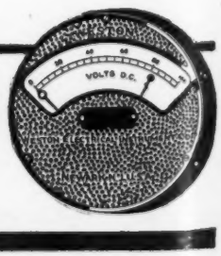

Electrical World

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W. H. ONKEN, JR.
Editor

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Southeastern Division Optimistic

THE South has faced and minimized an unprecedented water shortage during the past summer through combined effort. All its resources were pooled and power was delivered where most needed so that few utility companies have been forced to stint their customers materially. The battle virtually over, light and power men gathered at the N. E. L. A. division convention in Chattanooga last week to celebrate their fight and to plan for the future.

A spirit of enthusiasm and co-operation permeated the whole atmosphere at this meeting and showed unmistakably the confidence of utility men that the South is coming into its own. Growth, expansion, better service and better public relations were keynotes of the meeting. Reports from all parts of the Southeast indicated that the favorable labor conditions, the power facilities and the natural resources of the region are attracting national attention in ever greater degree and stimulating the rapid development of the territory that is everywhere manifest.

Water power has played the most important part in this progress, and it was the consensus of opinion that still greater water-storage facilities with supplementary steam power are needed to develop properly the resources of the region. In public relations, in rural service, in commercial activity and in engineering developments the men and women of the Southern light and power companies are doing great work. They have reason to be proud of their convention and their achievements.

Comparative Economies of Steam and Hydro-Electric Stations

THE skill displayed by steam-station designers, even with costs double those of ten years ago, makes it necessary for hydro-electric advocates to watch carefully the performance of their systems. There are, of course, localities like Niagara Falls or the Pacific Coast where water abounds, but not coal, in which hydro-electric stations will maintain their supremacy; but in a great many cases involving load factors such as normally obtain in industrial and metropolitan districts the steam station is making an excellent showing as compared with its hydro-electric competitor.

Of course, many hydro-electric systems involve transmission of electricity, which means high initial cost if the service is to approach that of local steam stations in reliability. The recent unprecedented droughts have also told heavily on hydro-electric systems, necessitating greater steam or other reserves and thus further narrowing the factors favorable to hydro-electric developments. It speaks well for steam-station engineering when stations costing approximately $100 a kilowatt can turn out a kilowatt-hour of energy for seven mills. Hydro-electric developments will, of course, continue to be made; but the odds are no longer all on the side of water power. There is greater opportunity for improvement in steam stations, the over-all efficiency of the best of which approximates only 25 per cent, whereas hydro-electric stations have already almost attained maximum.

Needless Fear Over Interstate Electric Power

REGULATION of public utilities in some form now obtains in all but one state, and while efforts have been made at divers times and in sundry places to dispense with the commissions, the fact of their existence is evidence of the efficacy of regulation. However, a small portion of the utility business is interstate in character in that the lines cross state boundaries, and this fact has given some politicians concern. Thus far the state commissions have handled the situation admirably and protected the ultimate consumer in his enjoyment of cheap electrical service. Moreover, Secretary Hoover is of the opinion that federal legislation is unnecessary and that the state public service commissions possess ample authority in the premises.

The governors of New York, New Jersey and Pennsylvania, however, have appointed members to a tri-state power committee. Governors Smith and Silzer have chosen as the representatives of New York and New Jersey men versed in regulation and qualified to pass mature judgment on regulatory matters; but Governor Pinchot, to whose urging the whole affair is probably due, appoints the men who were chiefly responsible for the "Giant Power" report. Obviously the committee is unbalanced and little may be expected from it except a lot of publicity emanating from Pennsylvania. If the commissions of all the states felt that some action was necessary to safeguard the states against the encroachments of the national government, they would have taken action at their Washington meeting last month. Certainly, Governor Smith would not be so impressed with the prospective benefits for New York from the giant power plan were he to investigate the actual amount of energy it is likely to produce.

Widening Service to Industry

NEARLY half of the registrants at the recent industrial electric heating school at Boston were central-station power customers who had been invited to share the benefits of the sessions with the manufacturing and utility interests under whose auspices the gatherings were held. Such evidence of deepening business friendship is in itself gratifying, but perhaps the chief significance of this mutual participation in intensive study of current progress lies in the co-operation made possible through the interchange of views and experiences by those present. From such a course, brief though it may be, users of electric heating apparatus gain larger understanding of the principles involved in its design and of the trend of development for different kinds of service. Manufacturers and

central-station men receive an opportunity to obtain first-hand information about service performance, and the joining of these facts and ideas is sure to be beneficial to all concerned. When users of utility service will take the trouble to attend sessions of this kind and spend days at the job to boot, it proves that highly satisfactory and helpful relations exist among the several interests represented, and those responsible for the Boston school are to be warmly congratulated on this result of their efforts.

Trimming Shade Trees

INASMUCH as the heaviest trimming of shade trees is done at this time of the year, it would be well for executives to give a little consideration to the subject. So long as there are overhead wires and shade trees on the same street, trimming is obviously necessary in the interest of better service. However, the job should be intrusted to an experienced forester and not to an ignorant or careless lineman. Too often tree trimming have been crude and criminal, damaging not only to the tree, but also to the public opinion of the company responsible for the pruning.

As a matter of policy, tree trimming should be left entirely in the hands of the city park department, or tree warden, or whoever else possesses public authority in such cases. In any event the situation should be handled diplomatically, and whether the city or the company does the pruning the rule should be to trim the tree so as to preserve its symmetry. The utility company has just as much interest as the citizen in making and keeping the town or city attractive, and shade trees are as big an asset as well-kept lawns, gardens and homes. Besides, there is too much sentiment entwined about beautiful trees to permit any public utility company wantonly to kill, maim or destroy their beauty. No electric light and power company should ever want to do such a thing, but unfortunately trees are butchered and lines are forced underground —and some managers cannot see that one is the effect of the other.

An Opportunity for Metermen

CENTRAL-STATION metermen appreciate the benefits which will accrue to them, with the growth and interconnection of power companies, if they train themselves along scientific business lines as well as along those of technical skill. At a recent meeting of the meter section of a state utility association the delegates showed their conviction that by broadening their training they could enhance the importance of the meter department in the minds of the company heads.

The metering art has kept pace with the growth of the industry, and metermen have successfully met the increasing demands caused by the rapid growth in the use of electrical energy. During this growth the scope of the department has widened until from a mere reading and recording of meters it has become responsible for all the testing and engineering in connection with metering. There is, however, a great field for progress in the administration of the meter department and in its development as a powerful factor in obtaining and holding customers' good will.

Standardization of testing, more efficient recording and a thorough and intensive training of meter department employees in the principles of good public relations are some of the directions in which improvement can be made. Many executives of light and power companies already appreciate the importance of the meter department as a check on the efficiency of company operation and as a department bringing wide public contact, but its future will depend largely on the efforts of the meter-men themselves.

You Are the Company

EVERY employee of a public utility personifies the company in the eyes—and ears—of those with whom he or she comes in contact, from the family circle to the invisible person at the end of the telephone wire or the recipient of mailed communications delivered miles away from the office. Corporations rendering these indispensable services cannot escape developing personalities which are merely the integrated characteristics of the individuals on the payroll, accentuated as these must be by the personalities of the executives whose lightest touch upon the steering wheel deflects the policies and acts of the corporate whole into wise or unwise channels through the great sea of public opinion. The responsibility is never-ending; as each new generation must save the republic, so each new employee must do his or her part in saving and building the reputation of the organization. First, last and all the time, then, let the ambassadorship of the humblest and of the highest in the service be declared and maintained. Old as this truth may be to men grown gray in the utility field, let it still be taught and exemplified in the utility family in the interest of good will and helpfulness to all. So may the cause of public relations be served as long as the industry shall endure.

Philadelphia Co-operates

ABROAD and comprehensive plan for co-operative sales and advertising effort between the central-station company on the one hand and the electrical contractor-dealers and jobbers on the other has just been announced by the Philadelphia Electric Company. Somewhat similar plans have been in effect in other cities, but the Philadelphia program is, if anything, more liberal. Under it an electrical contractor can, if he be so minded, conduct an extensive and profitable appliance business with virtually no investment either in stock or deferred-payment accounts—the company assuming the sales contracts and reimbursing the contractor at list prices. The company also offers to pay a 15 per cent commission on appliances selected for special campaigns, and it is running advertisements urging all to buy from their local electrical dealers. Thus an exceptional opportunity is offered the retail electrical dealer to demonstrate his ability and importance as a distributor of electrical appliances.

How well the plan will work out will depend largely upon the initiative of the contractor-dealers themselves. If they are, as they have indicated, really anxious to engage actively in the retail distribution of electrical appliances, they could not well ask for a better proposal. On the other hand, if the contractor-dealers were fully alive to the merchandising possibilities in connection with every wiring job, it would hardly seem necessary for a central-station company to devise an almost paternalistic plan of this kind. The results will be awaited with keen interest throughout the electrical industry.

Temperature Regulation by Means of Thermionic Valves

THREE-ELECTRODE thermionic valves, now so familiar in connection with radio transmission and reception, are gradually finding new applications as useful adjuncts in power apparatus, mainly for measuring and regulating purposes. The inertia-free relay action of such valves makes them particularly valuable for prompt and sensitive adjustment to changing conditions. They have been already applied to regulating the voltage of electric generators and the speed of electric motors. More recently they have been used successfully for temperature control of a furnace.

A sufficient number of thermionic valves are connected in parallel to give the needed current-carrying capacity, and the plate circuit is used for obtaining the required variable current. The grids are connected to a number of thermocouples in series, with a counter-emf. battery between the two. As the temperature of the furnace and the emf. of the thermocouples increase the net grid voltage is reduced, causing an instant decrease in the anode current. The latter can be used for regulating purposes in any desired manner, direct or indirect. The resulting response is quite sensitive, first because of the counter-emf. and, second, because of amplification.

This use of thermionic valves is of interest, not only in view of a large number of industrial and laboratory furnaces in which accurate temperature regulation is required, but also as pointing to other similar applications. The method is applicable to an electric furnace as well as to one in which fuel is used. Even though the primary responsive device (in this case thermocouples) has not a sufficient current or voltage range to actuate the regulator proper, a response is instantly magnified a hundredfold for operating the regulating mechanism. To put it another way, one more span has been placed on the bridge between microamperes and amperes.

Putting a Cash Value on Sales Activity

MOST central-station executives think in terms of dollars as naturally as their engineers turn to units of electrical measurement in analyzing policies and projects. Hence the ability to translate the gains and losses of technical and sales activities, whether experienced or estimated, into financial conclusions is one of the most effective agencies of commanding the interest and winning the approval of officials responsible for company development. Failure to express sales department affairs in monetary terms or to reduce complex engineering problems to a cost basis puts the man behind the report or recommendation at a disadvantage. Therefore it is good to see a marked tendency in departmental reports of electric utilities toward the financial evaluation of their work.

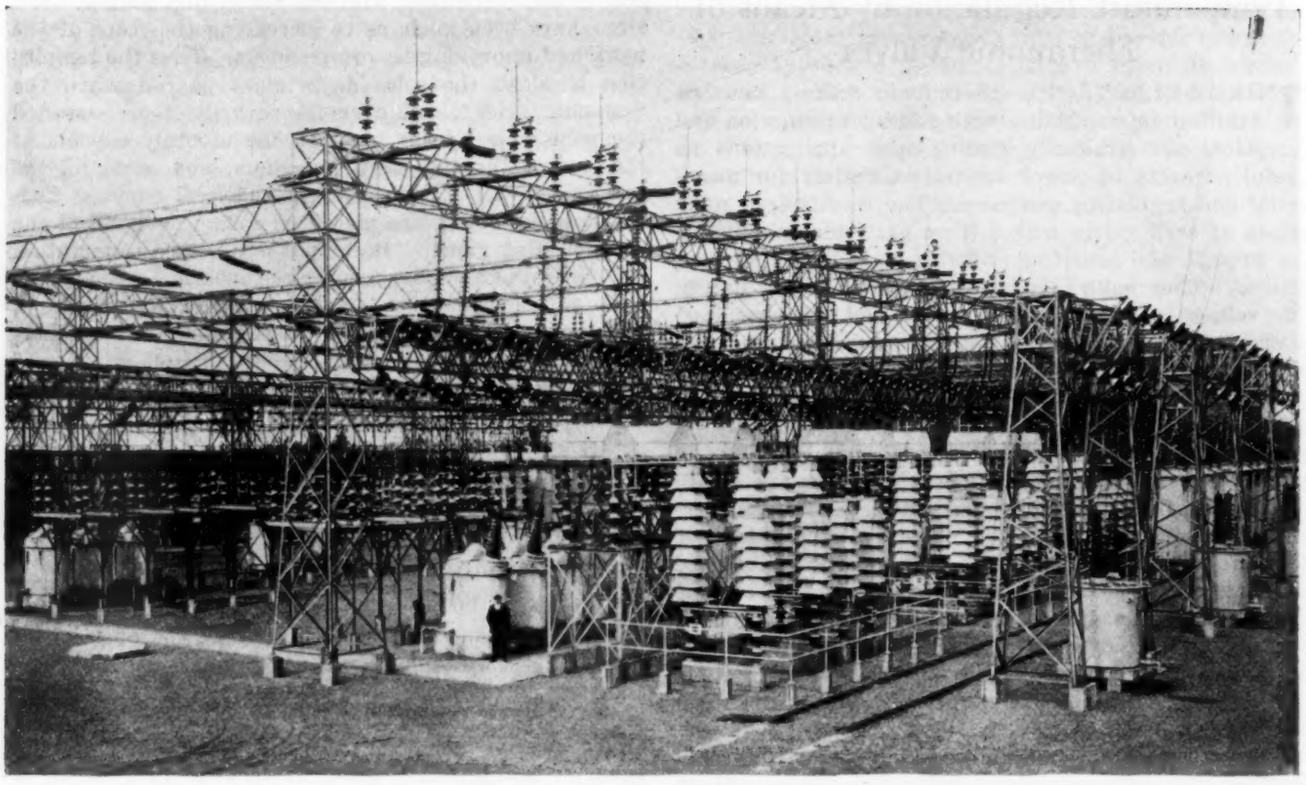
One syndicate, for example, established an illuminating engineering section in its industrial service bureau about a year ago. The first twelve months' work saw $60,000 of increased annual revenue from lighting added to the income of the operating companies. Another central-station company which "put on" an illuminating engineer recently gained over $48,000 in increased income last year from the 1,000 kw. added by his activities. Month by month the records of these sections have been analyzed and made constantly available to the executives, with the result that prompt decisions have been made as to increasing the scope of the work and improving its organization. Thus the temptation to slash the sales department payroll when the economic skies cloud over temporarily never assailed the men whose desks received the monthly reports of these newly created section leaders, and amid all the ups and downs of rate changes and local business fluctuations the cash value placed on sales activity kept the load-building game at its height and helped to maintain net earnings in all the companies concerned. Connected load and consumption statistics have their place in summaries of departmental work, but to offset their cost as determined by enthusiastic, conscientious and ambitious accountants the use of the dollar sign in its proper place is warmly commended.

How Every Refrigerator User Can Be Made an Electric Service "Prospect"

KNOWING the value of an electric refrigeration load in every home, wide-awake electric utility companies which have found an answer to the question of servicing the equipment are aggressively seeking such additions to their business. One of the biggest impediments to sales is price, and at present the solution is either to convince the prospective purchaser of the value in health and comfort of such an investment or to enable him to distribute his payment over a period of time.

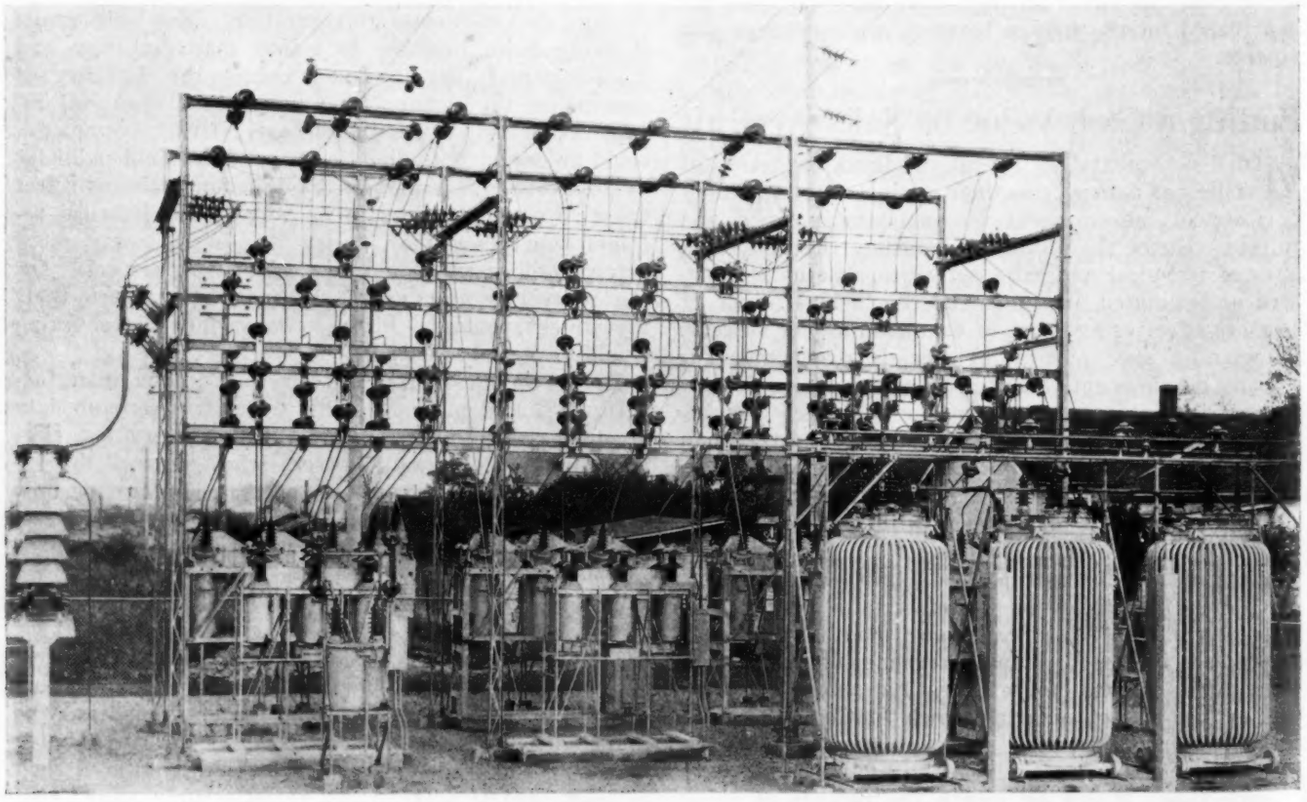
Results could be obtained more rapidly, however, if icebox manufacturers, electrical refrigerator manufacturers, ice companies and utilities would unite in telling the same story to the public concerning the danger to health that lurks in poor refrigeration and the things that constitute a good refrigerator. Separate publicity on these facts put out by each group would create more demand for high-class refrigeration. Not only would it bring more business to icebox manufacturers and ice companies, but it would reduce the difficulty of convincing the public that the price of electrical refrigeration is a wise investment. Utility companies could go one step further in their educational publicity by suggesting that persons buying new iceboxes select those so constructed as to be adapted to electrical refrigeration when they desire it. In this way more refrigerator users would be made "live prospects" for electric refrigerators and purchased power because their investment could be made in two steps and nothing would have to be scrapped.

Here the question arises whether icebox manufacturers will and can make boxes which will accommodate accepted refrigerating machinery. If they cannot, electric refrigerator manufacturers might do well to consider selling their boxes first and the refrigerating unit later. Co-operative action, however, might bring about the installation of more electric refrigerators than of the non-electric kind. Until such time as electric refrigeration is firmly intrenched electric refrigerator manufacturers might be able to reduce the cost of electric refrigerators by jointly agreeing upon a few types of boxes which would accommodate their units and by buying these boxes from the larger producers, who could sell a few standardized boxes at lower cost. Later or for special trade special boxes could be offered such as each electric refrigerator manufacturer might consider best for his trade.



Standardization in Outdoor Structures

OUTDOOR substations are now used universally, and the present trend in the art is toward a reduction in the number of types required on each system and a standardization in design and layout. The engineers of the American Gas & Electric Company have done a great deal to standardize and develop outdoor structures, and the accompanying illustrations show representative practice on that system. In the above view is shown the 100,000-kva., 132,000-volt Sunnyside substation. Below is seen the Robb Avenue substation at Lima, Ohio.



Dix River Hydro-Electric Development

Existence of Superpower System Makes Possible Practically 100 per Cent Utilization of Stream Flow—Plant Designed for Variation of Head from 165 Feet to 235 Feet

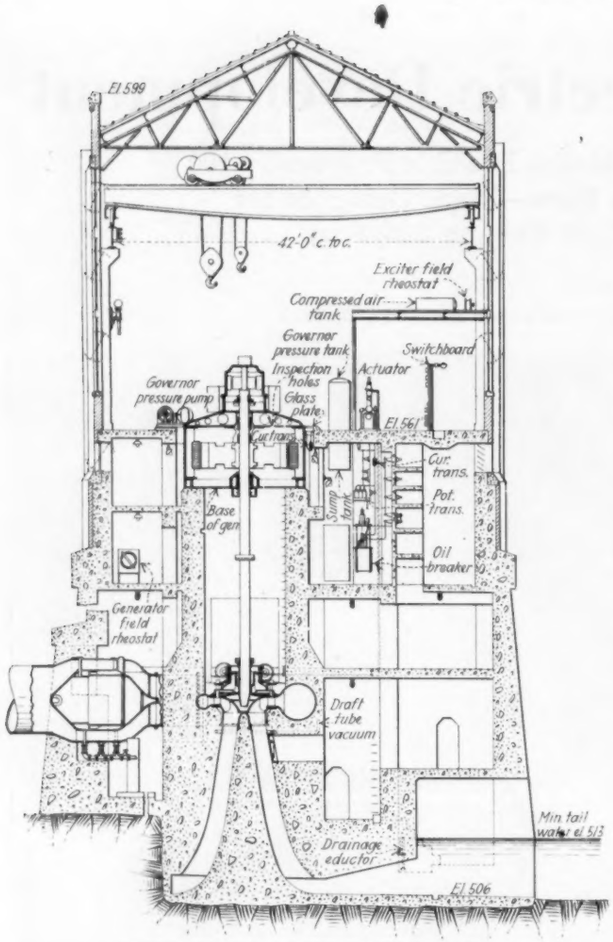
By F. A. DALE
Principal Assistant to L. F. Harza, Hydro-Electric Engineer, Chicago

DIX RIVER DEVELOPMENT DURING CONSTRUCTION
Outdoor substation in left background, power house in foreground. Location in narrow gorge offered many advantages, but some problems for the contractor

THE DIX RIVER station of the Kentucky Hydro-Electric Company, near Lexington, Ky., is an example of a type of hydro-electric development made possible by the growth of great interconnected systems of power generation and transmission. On a river the stream flow of which averages 550 sec.-ft. and varies from almost zero in summer to 28,000 sec.-ft. in flood, it has been possible to build a plant to utilize economically the entire flow of the river with a turbine capacity of 1,450 sec.-ft. This almost complete utilization of stream flow has been accomplished by the construction of a reservoir and associated power plant designed for a variation in head from 165 ft. to 235 ft. The reservoir formed by a rock-fill dam, believed to be the highest of its type in the world, has a maximum depth of 240 ft., a length of 33 miles and an area of 2,940 acres, and when drawn down 70 ft. will yield an equivalent of 24,000,000 kw.-hr. The intake gate is low enough to allow a considerably deeper draw-down. It is estimated that the annual energy output will reach 80,000,000 kw.-hr., with a minimum twenty-four-hour rate of 5,000 kw. The plant has an installed capacity of 22,500 kw.

The Dix River station is an important connecting link in the rapidly growing interconnected system of the properties of the Middle West Utilities Company. Lines are now in service from the coal fields of Virginia and eastern Kentucky through central Kentucky and northwestward to Louisville. Interconnection is made at Louisville with lines of other subsidiaries extending northward into Indiana and Illinois. Energy from the Dix River station will be distributed over the company's 66,000-volt transmission lines that are now in operation from Dix Dam to Pineville, Louisville and Lexington. Lines operating at 33,000 volts will carry power from the dam to the neighboring cities of Nicholasville, Lancaster and Danville. Load dispatching for the entire system, which also includes steam stations at Pineville and Varrilla, Ky., and Pocket and Dorchester, Va., will be handled from the Dix dam station. On account of the wide range in flow of the Dix River, the full utilization of the stream flow would be impossible were its development not to be interconnected with these various centers of generation on the large interconnected system operated in this section of the Ohio River territory.

On account of fluctuations in tail water level amounting to 40 ft., the substructure of the power house is unusually high. However, it was found possible to use a large portion of this substructure for the housing of the bus structure, switching equipment and miscellaneous auxiliaries.



CROSS-SECTION OF DIX RIVER STATION

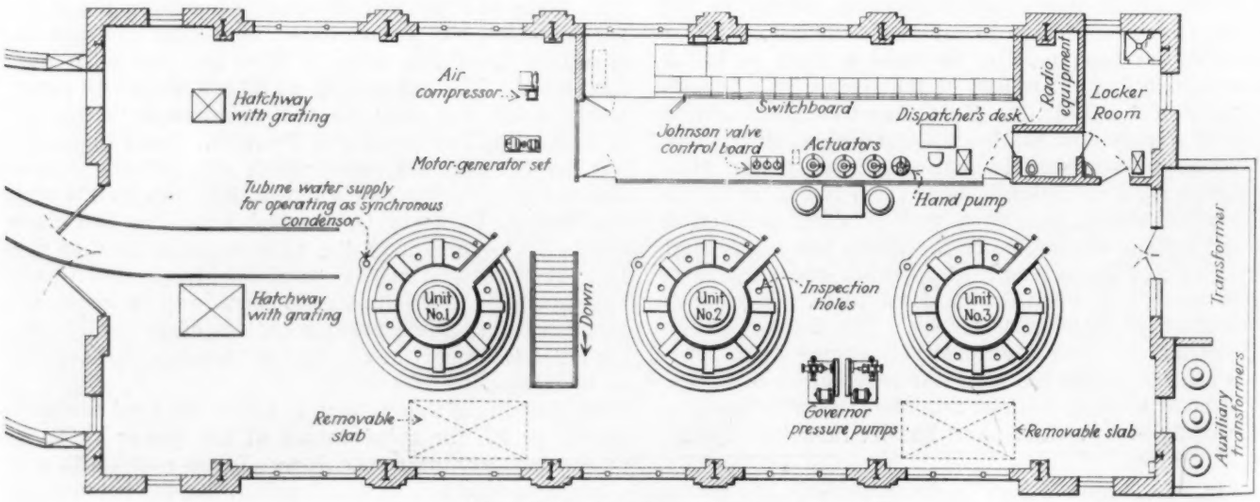
The high substructure necessitated by the possible rise of 40 ft. in the tail waters is utilized for housing the bus structure, switching equipment and miscellaneous auxiliaries

The main floor of the power house is located at the level of the top of the generator stator frames, hence the air discharging from the generators passes directly outdoors without entering the main operating room. Cooling air for the generators is drawn in through louvres on the river side of the power house and passes downward through the bus structure room. Openings are provided in the floor of this room through which the cooling air is drawn into a large basement room, from which the air passes into the wheel pits. It then travels upward and passes through the generators, which discharge it into the warm air chambers beneath the main floor of the power house. Ventilating sash are provided in the upstream wall of the power house, through which the warm air may pass outdoors. In the winter this warm air may be used for heating the power house, by closing these ventilators and opening registers, which will allow the air to pass directly into the operating room.

Only the exciters and upper bearing brackets of the generators are visible above the main floor. It was considered desirable by the operating company to render the remainder of the generators visible from the main floor, and for this reason an opening 9 in. wide was left between the outside of the generator stator and the floor. This annular opening is covered with heavy glass plates, and floodlights that illuminate the stator frame are installed beneath the floor. In addition, in the cover plates between the spider arms of the generators are installed port holes, which permit a view past the rotor into the wheel pit below, which is also illuminated.

Removable slabs are provided in the main and next lower floors of the power house immediately over the Johnson valves, through which the crane hook can be lowered and valve parts raised to the power house floor. The valves may be controlled at the valves themselves or from the switchboard room. The bus structure and low-tension switching equipment are located in the basement, with busbars and disconnecting switches on one side of the concrete cell structure and current and potential transformers and oil switches for generators and feeders on the other side. Daylight illumination has been provided on the busbar side of the structure by making the air intake louvres of heavy wired glass. The oil switch and potential transformer gallery is entirely separated from the remainder of the power house by fire walls and doors. High sills have also been provided at all doors to confine oil.

The parts of the substructure not occupied by hot air rooms and switching equipment are used for oil storage and filtering plant and miscellaneous storage. A sump is provided at the lowest point in the basement, to which seepage and any drainage that could not be dis-



MAIN FLOOR OF DIX RIVER STATION

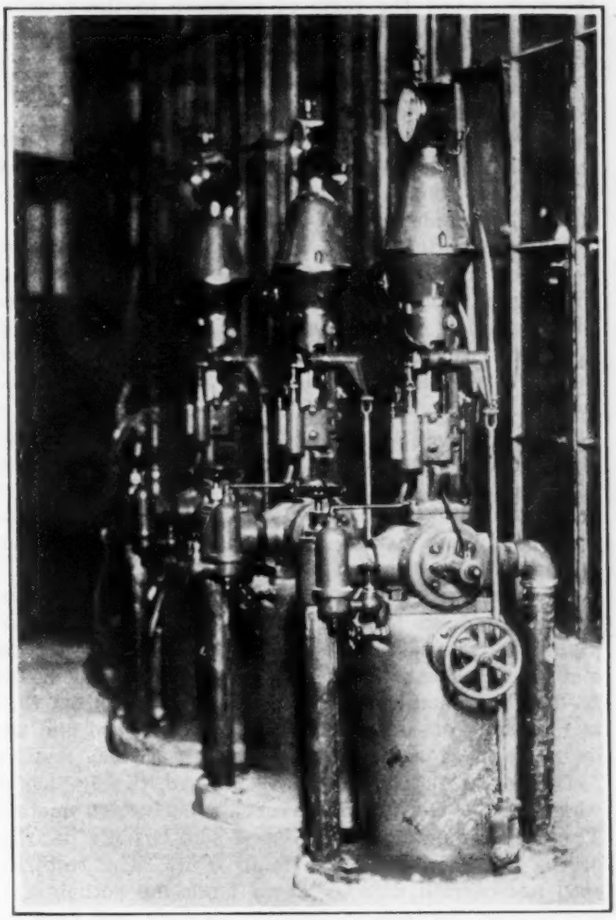
Note centralized grouping of main switchboards, dispatcher's office, carrier current equipment and turbine governor actuators.

charged above maximum tail water is led, and from which it is pumped by means of a float-controlled water jet eductor.

Practically all controls for the operation of the plant have been centralized in the switchboard room, located on the main floor. This room is completely inclosed with glass panels in order to shut out noise from the generator room. In addition to the switchboard for the control of the generators, low-tension feeders and high-tension switches in the nearby substation, this room also contains the dispatcher's system layout board and carrier current telephone equipment, governor actuators that control the turbine gates, remote control for the Johnson valves, remote control for the head gate located in the intake tower, and head- and tail-water indicators. The grouping of governor actuators at a central point, as has been done in this installation, is somewhat unusual and is made possible by the use of motor-driven fly-balls. The centralized location of actuators offers considerable advantage in convenience of operation.

On account of the magnitude of the project and its accessibility, it was felt that a large number of visitors would be attracted to the plant. For this reason more than usual attention was given to the architecture and finish of the power house. The superstructure is built of red face brick trimmed with white artificial stone, and a pitched roof is used, covered with light green Spanish tile.

The interior walls are finished with buff-colored face brick, and the floor is surfaced with small red quarry tile. The entire construction is of fireproof material, the roof slab being of precast gypsum.

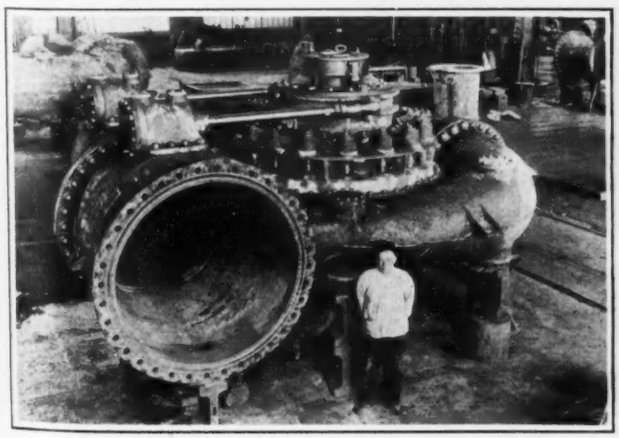


GROUPING OF GOVERNOR ACTUATORS IN SWITCHBOARD ROOM MADE POSSIBLE BY USE OF MOTOR-DRIVEN FLY-BALLS

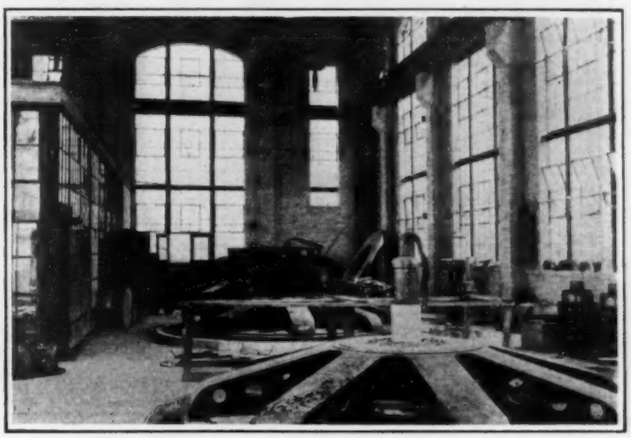
DETAILS OF EQUIPMENT

Penstocks.—The penstocks that connect the turbines with the tunnel are 8 ft. in diameter. At their upper ends they are sealed into the 24-ft. horseshoe-shaped tunnel by means of a large concrete plug. The maximum static head on the penstocks is 220 ft., and they are designed for a head of 300 ft. to allow for water hammer. The metal is $\frac{5}{16}$ in. in thickness, the longitudinal joints being triple-riveted double-butt, the girth joints being either double- or single-riveted lap. A sliding expansion joint is provided in each penstock midway between the power house and tunnel. The average length is 230 ft. Maximum water velocity at full load is 8.6 ft. per second, and the corresponding estimated loss of head is 0.7 ft.

Johnson Valves.—At the power house each penstock enlarges to a diameter of 10 ft. to form the plate steel casing of a Type B Johnson valve. The discharge diameter of the valve is 66 in. A short piece of cast-steel pipe is inserted between the valve and turbine casing, to facilitate the removal of valve parts. Full control of the valve is provided either at the valve itself or in the switchboard room. At the remote control desk in the switchboard room lights are provided that indicate the position of the valve. The valves are equipped with an automatic safety closing device, which shuts



9,850-HP. DIX RIVER TURBINE
Designed to operate at 300 r.p.m. under variable head from 165 ft. to 235 ft.



GENERATOR FLOOR WITH SWITCHBOARD ROOM AT LEFT
Only exciters and upper bearing brackets of generators visible above main floor

the valve when the ratio of pressure in the penstock to the pressure at the discharge end of the valve exceeds a certain predetermined amount.

Turbines.—The turbines were furnished by William Cramp & Sons and will deliver 11,000 hp. each at 235 ft. head. The operating speed is 300 r.p.m and the specific speed 35 r.p.m. Estimated runway speed is 585 r.p.m. The spiral casing, runner and guide vanes are cast steel. The guide bearing is lignum vitæ.

The conventional type of labyrinth seal rings was used, but provision is made in the design for replacing these with rubber seal rings in the future if desired. The operation of the generators as synchronous condensers is contemplated, and under such circumstances the turbine casing will be dry. An axuiliary water supply is therefore provided for the lubrication of lignum vitæ bearing and runner seals. For the latter, supply pipes were tapped into the upper and lower runner clearances at several points around the periphery and were connected with a circular manifold. A valve with handwheel conveniently located at the main generator floor controls the auxiliary supply.

Governors.—Servo motors operating the turbine gates are mounted on the spiral casing, and the pressure piping is carried to the actuators and pumps on the main floor. The servo motors have a capacity of 25,000 ft.-lb. The pumping system is of the centralized type, and consists of one sump tank, two pressure and two accumulator tanks, one each of the latter being a spare.

The actuators are Type G Woodward, the fly-balls of which are driven by squirrel-cage induction motors. The three actuators are grouped side by side in front of the switchboard on the main floor. The restoring rods are carried directly down from the actuators to the floor at the level of the turbine deck, and here the motion is transferred through bell cranks to a horizontal rod installed in a trench in this floor and attached to the turbine shifting ring.

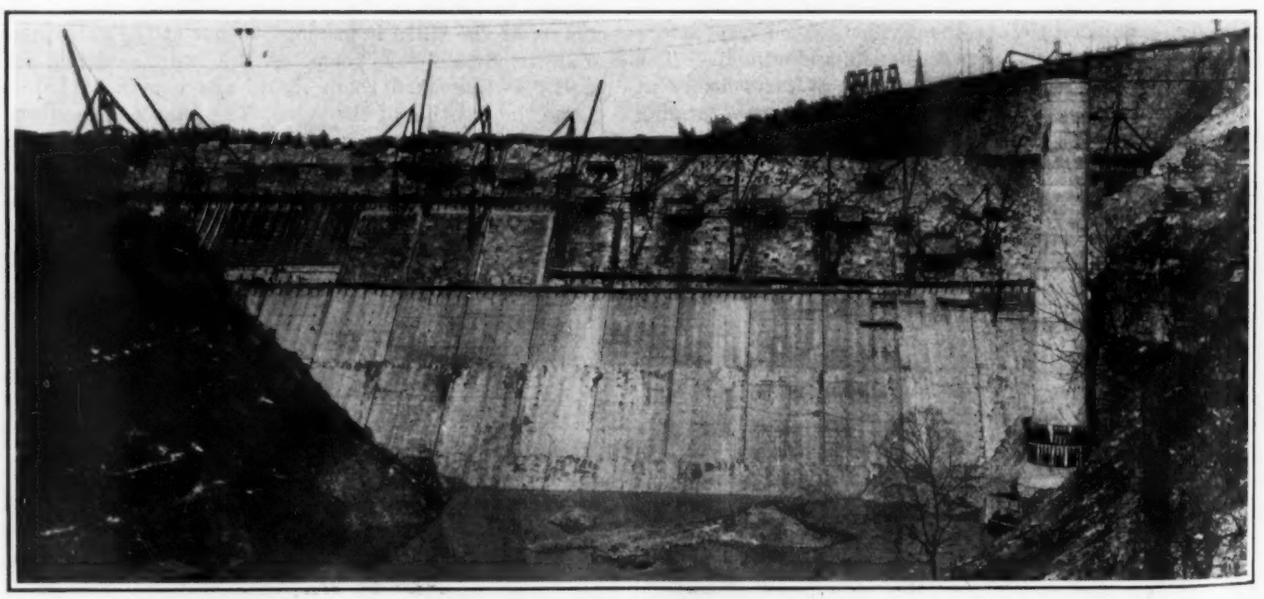
Generators.—The generators were furnished by the Allis-Chalmers Manufacturing Company. They have a capacity of 9,400 kva. each, 13,200-volt, three-phase, 60-cycle, and are equipped with direct-connected 80-kw., 250-volt exciters. The Kingsbury type thrust bearing is used, with a capacity of 175,000 lb. The flywheel effect of the rotor is 1,000,000 lb.-ft. squared. Temperature indicators are provided in the armature coils and also in the steady bearing, and are connected with indicating thermometers and alarm bells. The rotors are made of cast steel and were tested in the shop for an overspeed of 585 r.p.m.

WATER LEVEL INDICATORS

Water Level Indicators—Mercury column water level indicators are mounted in the switchboard room, one of which is connected with tail water by means of an air-pressure system and the other is connected directly with forebay level, by means of a pressure pipe laid in the floor of the tunnel. No water level recorders are installed, as it was considered preferable to have the readings read and recorded in the log by the operator at regular intervals.

At one end of the switchboard additional panels have been added, on which are represented all of the transmission lines, generating stations and load centers in this portion of the system. The different transmission line voltages are indicated by different colored lines. Switches on the system are indicated by circles or squares, in the center of which is a hole for receiving a pin with a large bright red head. The presence of the pin in the hole indicates that the switch is closed. When any change is made in the status of a switch, the dispatcher records such change by removing or inserting a pin. This system was used in preference to lights, inasmuch as it was felt that the condition of the system would be more strongly impressed upon the dispatcher's mind if he had actually to go to the board and make the change manually.

The execution of this development work was under the general direction of G. W. Hamilton, vice-president of the Middle West Utilities Company. The project was designed by and constructed under the supervision of L. F. Harza, consulting engineer, of Chicago, and its construction was carried out by the L. E. Myers Company of Chicago.



DIX RIVER DAM DURING CONSTRUCTION

Will be 35 ft. higher when completed; intake power at right with coarse screens in place and fine screens swung upward; 66,000-volt transmission towers in distance

A Lighting Service Department

What It Is and What It Can Accomplish for the Central Station—How It Can Increase Revenue and Improve Public Relations — Suggested Organization for Utilities

By D. J. FINN
Edison Lamp Works, Harrison, N. J.

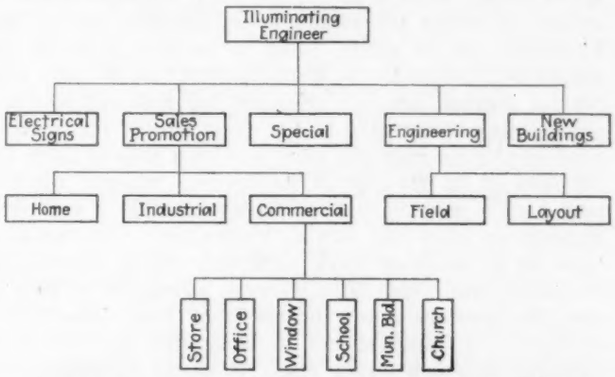
PERIODICALLY we see items of news pertaining to the successful accomplishment of this or that lighting service department. Quite often we read of courses in illumination being given by the various lamp manufacturers for central-station representatives, so as to prepare them to carry on a lighting service. Within the past few months much publicity has been given those progressive central stations that deemed it advisable for some one in each of their organizations to take the course in illuminating engineering sponsored by the Illuminating Engineering Society and the Lighting Bureau of the N.E.L.A. At the N.E.L.A. convention held in Atlantic City the combined resources of all the Mazda lamp manufacturers were centered in an effort to convey to the electrical industry an idea as to the value, aim and method of operating such a department.

Even with information such as this being constantly brought to one's attention, there are, perhaps, within the folds of the large central-station family many that have as yet to learn what a lighting service department really is. They are unaware as to how it functions and as to what it can accomplish.

Present indications seem to point to the fact that only time and a realization of the value of the lighting load will make this, the youngest member of the public utility organization, well known and recognized. There is every reason to believe, though, that this time is not far off, for each year finds the lighting load attracting more and more attention. Especially is this so when we stop to consider that with practically no special solicitation for the year 1923, the lighting load, which amounted to less than one-half as much as the power load, accounted for 62.4 per cent of the total gross revenue received by all the American central stations from the sale of electrical energy. Certainly there is sufficient food for thought in these figures to make one pause a moment and contemplate how or by what means this revenue-producing load might be made even more valuable, both from a monetary and a good-will standpoint.

It has been found that if the public utility is to make this revenue-producing load of a greater and ever-increasing value, a department must be created which has for its goal better lighting. In some central stations such departments already function, being known under various titles—for example, illuminating engineering department, illuminating engineering bureau, etc. The name, however, that seems most descriptive of such a department and that finds the widest use today is lighting service department. Briefly, a lighting service department may be defined as that department within the central-station organization the expressed purpose of which is to render illuminating engineering advice gratuitously to all its customers.

As can be readily appreciated, a service such as this is rather comprehensive and far reaching. If the central station is actively to engage in such work and at the present has no one looking after such matters, it will mean that if it expects to carry the work to a successful conclusion some addition to the existing personnel will be required. The extent of this addition, of course, will depend to a large extent upon the size of the individual public utility and the community it serves. One would hardly expect to find in a very small company a lighting service department of as large pro-



ORGANIZATION OF A LARGE LIGHTING SERVICE DEPARTMENT

portions as the one shown in the accompanying chart, but would rather expect to find in each company at least one individual whose entire time is devoted to the subject of lighting.

Due to the fact that some time will elapse before the public becomes thoroughly acquainted with the services offered by the company, there should not be at first an excessively large demand for such services. This makes it possible initially for one man to take care personally of all the requests for information pertaining to the various phases of good lighting practice. However, once such a department is established, the one put in charge should not sit back on the oars and wait for requests to come in, but should assume an aggressive attitude and go out for the business. One way in which this is possible is through the medium of lighting surveys. Information derived from such surveys will also serve as a background for much future work that such a department can carry out. Having one man in active charge of all these lighting activities means that he must be a man of high caliber and be thoroughly grounded in all the fundamentals of lighting practice. As the requests for lighting information increase and the department grows and expands, men within the organization can be trained to take over the activities of certain definite fields, finally developing by a gradual but steady process until that stage is reached when the department assumes the proportions of the organization

heretofore illustrated as an ideal lighting service department.

It might appear that a department so constituted would be rather expensive, especially when one considers the basis upon which it is to operate. On first thought it might seem that the company was supporting a department that, in final analysis, would show a balance on the wrong side of the ledger. Nothing could be further from the truth than a conclusion such as this. Invariably a properly conducted lighting service department shows a substantial financial return through increased sale of electricity. Although this visible cash profit might prove sufficiently alluring to some, one should not lose sight of the fact that in reality it is only a secondary consideration, because it is possible for such a department to show returns in the nature of enhanced good-will and customer relationship—returns that cannot be measured in monetary terms.

Much space would be required if the complete story of increased lighting revenue resulting from the efforts of a lighting service department were to be given full justice. Still, it would seem somewhat inconsistent if no reference were made to the very splendid financial return to which practically every lighting service department can lay claim. Just to mention a single instance that comes to the writer's mind: an average size central station, not yet prepared for the well-rounded organization illustrated in the chart and at the present time employing only one man, has been able to show an increase of 32 per cent in its lighting revenue for the past twelve months. This achievement is even more impressive when the fact is known that this increase came as a result of work with only thirty customers. In dollars and cents this increase amounted to $8,531 over the previous year's income from these same thirty customers, an amount not to be scoffed at even in a company of much larger size. It would be possible to go on citing example after example as to how such an organization has proved successful from a monetary standpoint. In viewing the subject from this angle, one should not lose sight of the fact that the primary purpose and ultimate goal of such a department is to create good-will and better public relations rather than merely show increased financial returns.

The need of some medium for improving customer relations has been a long-felt want in the central-station industry, for no matter how high the central station may stand in the estimation of the community, there are few, if any, of its executives that would not welcome the opportunity of strengthening this relationship. In a lighting service department they have at their command one of the finest mediums known for realizing this desire.

The way in which a lighting service department can bring this about can possibly best be illustrated and more forcefully brought home by means of an example. Suppose some more or less influential person in the community comes to the central station in quest of information pertaining to the lighting of his new store, home, factory or other interest. The central station, to all intents and purposes, should be the one authority in the community that is in the best position to render unprejudiced and good illuminating engineering advice on such occasions. Now, if the central station has the proper set-up within its organization, a request such as this can be taken care of with great ease and a lasting and favorable impression be made upon the mind of the inquirer. If, however, the central station has neither a lighting service department nor any one who devotes his time exclusively to work of this nature, the customer will most likely be forced to go elsewhere to obtain the information. As a result of this he may form the derogatory conclusion that the central station is not as progressive and as interested in his problem as it should be. Thus we see that by not being in a position to furnish this service the public utility has missed an opportunity to assist its customer, as well as the chance of creating a better relationship.

Carrying the example still further, it may so happen that the individual the customer is compelled to consult is not familiar enough with the principles of lighting to know just what intensities and type of equipment would be best suited to meet requirements. Circumstances such as these mean only one thing—the customer will be the recipient of an inferior lighting job. This mis-advice acts as a boomerang to the central station in several ways. First, more than likely the lamps provided are of such small wattage that it is impossible for him to obtain that intensity of illumination which would be conducive of best results. This means that the central station is losing revenue it ordinarily should be receiving and the customer, having an insufficient quantity of illumination, eventually becomes dissatisfied with the lighting installation.

Second, the average customer unconsciously attributes this fault to the central station. Why? Because he is aware of only one thing—namely, that it is the central station that furnishes him with the electricity that produces artificial light, and if blame should be attributed anywhere, the central station should be held accountable for failures. Very few, if any, stop to consider that the fault may lie in the initial installation.

EFFICIENT SERVICE DEPARTMENT IMPROVES PUBLIC RELATIONS

Contrast this with a somewhat altered state of affairs: the same man comes to a central station having an organized lighting service department and asks for similar information. He is referred to the illuminating engineer, or, in the case of a large concern, to the man who devotes all of his time to the particular field of lighting that the customer is interested in. In this way he meets one who is in a position to talk intelligently with him about his particular lighting problem. Having this early contact, the company is in a position to render the customer capable engineering advice and later give him a complete engineering recommendation. With such a background, it is only natural to expect the customer to place implict confidence in the company, and consequently, when he follows the plan submitted, he obtains an ideal lighting installation. Such a state of affairs implies several things, the most important of which is that the impression made upon the mind of the customer is such that he feels somewhat indebted to the company, and if he is human, certainly must appreciate this gratuitous service. Besides bringing about this much sought after condition, the company places itself in a position to receive the increased revenue that naturally accrues as a result of better lighting. Although the case just cited is only a theoretical instance, but little imagination is required to visualize the cumulative and far-reaching effects such a procedure is capable of producing.

From the viewpoint of the company itself, such a department, besides being able to build up the lighting

load and good-will of the company, is also in a position to serve in the capacity of adviser and lighting engineer when special campaigns are undertaken. Once a central station has such a department, the advisability of immediately putting on a kitchen, store-lighting, show-window, sign or industrial-lighting campaign looms up. Campaigns such as these are revenue producers. They are activities that only a lighting service department is in a position to develop with maximum results.

Considering all these things, it seems fairly evident that now is the time to organize such a department, and not next year nor the year after. Those central-station executives who can read the handwriting on the wall know that if they would improve their company's good-will and increase its revenue with the least expenditure, they have but to create within their own organization a lighting service department.

How such a department was organized and what it was able to accomplish will be the subject of a later article.

Sealing Safety Service-Entrance Switches

Sealing With or Without Tops Is Found to Reduce Theft of Energy, Lessen Use of Pennies in Place of Fuses and Increase Protection to Customers

THERE are a great many hundred thousand safety service-entrance switches in use in the United States on central-station lines. There are a number of varieties of switches designed for and used in such service, and naturally opinion varies as to the relative merits of the different types. In all minds, however, there are two common objectives:

1. To provide a greater protection at the point of the main switch and fuses in order to guard against shock and injury in the renewing of main-line fuses, where there is a real hazard to the unskilled fingers of the customer should he undertake to install new fuses, and to reduce the likelihood of pennies being used because there are no large-size fuse plugs at hand.

2. To offer protection against the theft of energy.

The switch and fuse block are therefore contained in a metal cabinet which provides for external operation of the switch and is so arranged that the fuses on the line side of the metering equipment can be manipulated only when they are dead. In addition to this comes the opportunity, if desired, to permit the consumer to maintain his own fuses without danger.

In the sealing of these service-entrance safety switch boxes practice varies. Some companies place the seal on the box cover, trusting to the customer not to molest it, and rely on their meter readers and inspectors to report all cases where seals are broken. Others attach a tag to the seal warning the customer against breaking the seal and requesting that the company be notified in case of trouble so that a man can be sent at once. Still others, believing that the customer can be safely intrusted with the renewing of fuses and desiring to insure prompt restoration of service and minimum inconvenience to the customer, use a tag requesting the householder to break the seal, renew the fuse and notify the company.

The interesting consideration is, of course, the extent to which sealing fuses, with or without tags, results in maintaining the switch boxes actually under seal and the degree to which in actual practice the customer breaks the seal and leaves the box unfastened without the company having knowledge of the fact. Very scant actual data seem to be available on this point, but the following bits of testimony from prominent central-station companies about the country indicate the present experience and trend:

From an Ohio Company.—"We have approximately 10,000 sealed meter-service switches on our lines and do not experience any serious difficulty in having these seals broken, because the customer has branch fuses accessible to him and it is very seldom necessary for him to break the seal on the meter-service switch in order to renew the service fuses. An analysis of our trouble calls on our sealed services shows that a very small percentage of fuse trouble is in the meter-service cabinet. In other words, in more than 96 per cent of trouble calls on the new meter-service switches the service man finds the customer's fuse defective. Even on the single-circuit installations we require a branch fuse of not over 15 amp. capacity, accessible to the customer, and a 30-amp. main-line fuse is used in all 30-amp. meter-service cabinets."

From a Pennsylvania Central Station.—"We have about 160,000 safety switches on the system, all of which should be kept sealed, and we are making heroic efforts to keep them sealed. Whenever a customer breaks a seal without previous permission we warn him and even go so far as to threaten to disconnect his service if the offense is repeated, but our system of checking is rather crude and we often find safety switches unsealed where we cannot fix the responsibility. The customer simply says he knows nothing about the matter. More often he states that our man broke the seal, and while we have no records of any man visiting the premises, neither have we any direct evidence that the customer was at fault."

From a Kentucky Utility.—"We have on our lines approximately 15,000 sealed-fuse-type switches and 15,000 accessible-fuse-type switches. Of the sealed-fuse-type switches the number of boxes which have broken seals never runs less than 10 per cent. Of the 15,000 accessible-fuse-type switches the number of boxes with broken seals is under one-half of 1 per cent."

From a Connecticut Company. — "Safety entrance switch boxes were first used on the lines of this company in May, 1922, and there are approximately 20,000 of them on our lines at this time. A very small proportion of the seals have been found broken, owing, no doubt, to the fact that the fuses are accessible to the customer. The company does not tag the boxes, but each box bears a manufacturer's plate giving complete directions how to operate the switch. We find that the use of these 'A' boxes materially decreases the number of service calls. Our experience with this type of box

has been very satisfactory both from the company's standpoint and because of its usefulness to customers."

From a Kansas Company.—"We have approximately 850 safety entrance switches installed in all properties. No tags are used in connection with these switches, and consequently we find broken seals averaging about four or five a month. We feel that the sealing of these switches has minimized the danger hazard, since we have been finding fewer coppered fuses since putting in these switches. We are not able to state definitely what a service call costs but believe it will average about 75 cents. We have such a small percentage of safety switches installed that it is impossible to determine what definite influence they have on public relations."

From Minnesota.—"We have about 40,000 of these cabinets in use, and on a recent inspection we found about one-tenth of 1 per cent with the seals broken. The majority of these seals were broken by the customers, but in most cases the customer notified our trouble department that it was necessary for him to break the seal on the cabinet and the trouble department neglected to notify the meter department regarding the breaking of this seal. This condition was due to the trouble department not being fully notified as to just what it should do when a customer sent word that it was necessary for him to break the seal. We do not hang tags on the boxes directing customers to notify us in case of trouble, but we do direct them to break the seal, renew the fuse and notify the company. On our recent inspection no pennies were found on installations where the sealed type of cabinet was used, but on installations where the old-style cabinet is used the inspector collected about one hundred pennies in a total of 50,000 installations. Our records show that up to the present time no increase in service calls has been caused by sealing the cabinets."

From Massachusetts.—"We have approximately 2,500 of these standard service-entrance switch boxes on our lines. We instruct our employees when meters are installed in connection with these service boxes to seal them. We have asked the electrical contractors to inform us if their employees have to break the seal on these boxes, so that we may seal them again. We do not find a great many pennies in our service fuses. We do not find that our service calls have been increased materially since these switches have gone on our lines."

From a Wisconsin Company.—"We require that all service-entrance switches be sealed in accordance with the state code. It is estimated that approximately 5 per cent of the seals on service boxes are found broken, although we may have been informed in some cases by the customers that seals were broken. All employees authorized to cut seals are instructed to reseal service boxes properly upon leaving the premises, and we believe that boxes left unsealed by employees are very few. We do not permit customers to replace fuses in service boxes themselves, but if customers telephone stating that fuses in service boxes have blown, we send out a troubleman to replace them as promptly as possible. In some cases customers do not care to wait for a service man and state they are able to replace fuses themselves. In such cases we are very careful not to direct a customer to do this and inform him that the responsibility for doing so will rest entirely with him. When a customer informs us that he has replaced fuses we send a service man to the premises as promptly as possible, so that the installation may be checked and the box again sealed. Of course, there are cases of which we have no knowledge where customers replace fuses in service boxes, but in general it is the distribution fuse rather than the service-entrance fuse that blows, so that in most cases we are advised and can replace the main fuses ourselves."

From an Operating Organization.—"We have approximately 100,000 entrance switches on our lines and the percentage of seals which we find broken is very low. We find very few seals broken by customers unless they are given permission to break them by us, and since all of our employees have strict orders to seal all service-entrance switches, there are very few left open by them. We use a red tag on which is printed a notice to the customer to call the utility company in case of trouble and that he must not break the seal. In the majority of cases where a customer calls us to say that he is without light we give him permission to break the seal and renew the fuses and later on send a man along to reseal the boxes. I believe that the insistence on the sealing of service-entrance switches has reduced the menace of replacing fuses by pennies very materially. Our company has always maintained a trouble department, and while I have no accurate record of the number of trouble calls due to the use of service-entrance switches, I feel that these calls have not been materially increased."

RESULTS OF A MIDDLE WESTERN COMPANY SURVEY

Other evidence comes from a survey made not long ago on a Middle Western power system embracing 98,447 residence installations to see how many were improperly fused. About 16½ per cent, or some 16,200 homes, were found improperly fused; 3,274, or about 3 per cent, were found with no fuse protection, and 30,070 had safety cabinets, of which 2,808, or 9 per cent, had the seals broken.

The range of experience is seen to be wide. Estimates are given all the way from 10 per cent to one-tenth of 1 per cent. But the general sentiment seems to be one of satisfaction and confidence that sealing the fuse box with or without tags reduces theft of energy, lessens the use of pennies under dead plugs and lends material protection to the customer. There is no better evidence of this than in the action taken at the recent meeting of the wiring committee of the Southwestern Geographic Division of the National Electric Light Association at Hot Springs, Ark., when the following recommendations were made:

> This committee recommends to all member companies, in the interests of greater safety both to life and property, that, either by ordinance or police power of cities, there be required the use of safety-meter-type cabinets of standardized universal design, so that they will fit standardized meter trims, and that the service entering these cabinets be installed in conduit, and that all service in meter cabinets be kept sealed by the electric companies furnishing the service, the main-line service switches and meter-service cabinets to be fused to the full rated capacity of the switch. The fire prevention bureaus are giving their active support to have these cabinets installed to eliminate the fire hazards which are caused by overfusing where the customer has access to the fuses. The accident prevention societies also will support the installation of these cabinets as the inclosing of the switch prevents persons from coming in contact with it. Their installation should be a rule of the code.

The Western Association of Electrical Inspectors adopted a motion not long ago placing that association on record as recommending that in sealed service fuses the service fuse be not accessible to the customer.

Determining Demand Charge

Avoiding Discriminatory Rates and Distributing the Benefits of Diversity in an Equitable Manner

BY W. J. GREENE
Rate Engineer Iowa Railway & Light Company

ADOPTION of the three-part rate was considered very seriously by the writer as the exclusive rate for all services as early as 1893, but the idea was abandoned as a too radical departure from the current practices of the time. Recently, however, the three-part rate has been put into effect in several towns as the exclusive rate for commercial lighting and power service, and with satisfactory results. The same form of rate, but with higher values, is being offered as an optional rate in other towns and cities. By this means high-load-factor consumers are given part of the reduction to which they are entitled but still contribute partly to the support of low-load-factor consumers that are still rendered service on the present rate.

Exclusive and optional forms of rates for residence service are also a part of our rate system. In these forms the consumer charge of the three-part rate is employed, but the demand costs are covered in a meter step rate so arranged as to give results that are an approximation to those that would obtain from the three-part rate. It is hoped that at some future date the three-part rate will be the exclusive rate for residence consumers. Such a rate may some day be demanded by good load-factor consumers.

In the latest rural rate established by this company the three-part rate is employed. The customer and demand charges are set forth in detail in the rate, but are combined as "A Monthly Charge" before presentation to a consumer in the making up of the service contract.

To arrive at values for a Doherty three-part rate, the underlying principles of which were presented by the writer in the ELECTRICAL WORLD of Feb. 29, 1896, the various cost items must be allocated to the customer, the demand and the energy elements. With the cost items thus allocated accurately, an accurate and equitable unit customer and energy charge will result when the consumer and energy costs are divided by the number of consumer-months and kilowatt-hours respectively.

Determination of an equitable unit demand charge is not so simple. It will not be found by dividing the capacity costs by the sum of the consumers' demands, although the value thus obtained is an accurate average demand cost. An analysis will disclose that when a unit demand cost thus obtained is used as the demand charge, discriminatory rates will result. In other words, the method does not give a charge which distributes the benefits of diversity in an equitable manner.

The error of this method is shown from the following:

(1) Assume $7 to be the quotient found by dividing the monthly capacity expenses of production, transmission and distribution, including allowances for general expenses, contingencies and profits, by the peak load on the power plant or sources of supply corrected for line and transformer copper losses. With the capacity costs and the utility's peaks and copper losses accurately determined, this value becomes the true monthly amount that a 100 per cent load factor consumer should pay for capacity. Unless a rate is so constructed that such a consumer does pay that amount for capacity, in addition to his customer and energy costs, he is being supplied service at below true costs to him.

(2) Consider $1.88 to be the quotient found by dividing the capacity costs (1) by the sum of the consumers' demands. This value is the average monthly unit demand cost per kilovolt-ampere of demand.

(3) Let 3.7 cents be the quotient found by dividing the capacity costs (1) by the kilowatt-hours used by the consumers. This value is the average unit demand cost for the month per kilowatt-hour sold the consumers.

From the preceding it will be observed that where the demand charge is made a direct function of the consumers' demand, a 100 per cent load factor consumer would be furnished with capacity for $1.88, or $5.12 less than the cost charge. Where the demand charge is made a direct function of kilowatt-hours, the 100 per cent load factor consumer would be charged $27.01 for the average 730-hour month, or $20.01 more than the cost charge. It is also evident from the foregoing that where consumers' demands are used as the only basis of the demand charge, all consumers who have a load factor higher than the average will be charged too little an amount, and all who have a load factor lower than the average will be charged too large an amount. On the other hand, where the kilowatt-hours are used as the basis of the demand charge, all consumers who have a load factor higher than the average will be charged too large an amount, and all who have a load factor lower than the average will be charged too little.

If discrimination between consumers is to be avoided some basis other than the average demand charge must be devised.

The writer has worked out a method which he believes is a mathematically correct solution, and, when applied in connection with the customer and energy charges, would entirely eliminate discrimination among consumers. The solution involves a combination of the demand and kilowatt-hour methods. Part of the capacity costs are a direct function of the demands and the remainder is a direct function of kilowatt-hours. The proper values can be obtained readily by solving two simple equations in which:

x = the cost per kilowatt-hour of that portion of the capacity costs that function with the kilowatt-hours supplied the consumers.
y = the demand cost per kilovolt-ampere of that portion of the capacity costs that function with the maximum demand of the consumers.
D = the sum of the consumers' maximum demands.
P = the maximum coincident demand or peak responsibility of all consumers on the sources of supply.
K = the kilowatt-hours used by all the consumers in a year.
C = the total annual capacity expenses of all the consumers.
8,760 = the kilowatt-hours in a year for a 1-kw. load operated at 100 per cent power factor and 100 per cent load factor.

The equations are:

$$Kx + Dy = C$$
$$8{,}760x + y = C \div P$$

Using the same data as were used to obtain the preceding values of $7, $1.88 and 3.7 cents, the unit charges would be as follows:

The cost per unit of demand for the portion of capacity costs that vary directly with demand would be $1.50.

The cost per kilowatt-hour for the portion of capacity cost that vary directly with electricity used would be $0.0075.

By adding together the cost per kilowatt-hour for the portion of the capacity costs that vary with electricity used and the energy cost per kilowatt-hour, a charge or rate is obtained which to distinguish it from energy charge, may be termed the electricity charge or rate.

Analyzing Bids for Apparatus

Efficiency an Important Factor in Making Comparison—Formulas Derived as an Aid in the Computations Involved

BY THOMAS E. PENARD

Engineer of Electrical Division Station Engineering Department, Edison Electric Illuminating Company of Boston

IN CONSIDERING bids received by an operating company from two or more manufacturers of electrical apparatus, it often happens that the selection of the successful bidder reduces to a decision based on the comparison of efficiencies.

If the manufacturer offering the most efficient apparatus is also the lowest bidder, there is, of course, no problem. When, however, the most efficient apparatus is not the lowest in price, it becomes necessary to make a careful analysis to determine if possible exactly how much the purchaser can afford to pay for the more efficient unit. In other words, he must ascertain how much the losses mean to him in dollars and cents, taking into account not only the actual cost of generation, transmission and distribution of these losses but also the investment represented by that portion of the generating plant, transmission lines, substation and distributing circuits made unavailable by the installation of the less efficient apparatus.

The formulas derived below will be found useful as an aid in the computations involved. It is assumed that the losses are the same whether supplied over a lightly or heavily loaded transmission line.

Let

L_o = losses at no load, in kilowatts.
L_1 = losses at full load, in kilowatts.
$L_2, L_3 \ldots L_n$ = losses at various loads, in kilowatts.
$h_o, h_1, h_2 \ldots h_n$ = time in hours per year during which the corresponding loads are on.
d = per cent loss in distributing circuits.
t = per cent loss in transmission lines.

Then the losses in apparatus and in distribution and transmission, in kilowatt-hours, will be

$$\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right)(L_oh_o + L_1h_1 + L_2h_2 + \ldots . L_nh_n) \quad (1)$$

and the cost of generating this amount

$$g\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right)(L_oh_o + L_1h_1 + L_2h_2 + \ldots L_nh_n) \quad (2)$$

in which g is the manufacturing cost of generation, in dollars per kilowatt-hour.

The capital investment represented by this cost, on the basis of p per cent annual interest charges, is

$$I_1 = \frac{100g}{p}\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right)(L_oh_o + L_1h_1 + L_2h_2 + \ldots . L_nh_n) \quad (3)$$

The investment represented by that portion of the plant tied up in generating, transmitting and distributing the electricity to supply these losses is, for generating plant and transmission,

$$I_2 = \left(G+T\right)\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right)L_1 \quad (4)$$

and for substation and distribution,

$$I_3 = \left(S+D\right)\left(1+\frac{d}{100}\right)L_1 \quad (5)$$

in which

G = cost of generating plant, in dollars per kilowatt.
T = cost of transmission lines, in dollars per kilowatt.
S = cost of that portion of the substation affected by the additional losses, in dollars per kilowatt.
D = cost of distributing circuits, in dollars per kilowatt.

The total investment, I, represented is the sum of equations (3), (4) and (5) or

$$I = I_1 + I_2 + I_3 \quad (6)$$

Written in full, this equation is rather formidable in appearance, but in its application it is simple. The complete equation is

$$I = \frac{100g}{p}\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right)(L_oh_o + L_1h_1 + L_2h_2 + \ldots L_nh_n) + (G+T)\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right)L_1 + (S+D)\left(1+\frac{d}{100}\right)L_1 \quad (7)$$

Fortunately the quantities d, t, g, p, G, T, S and D may be considered constants, which are different in value for different systems. Once determined, these values may be used over reasonable periods of time, to be revised from year to year if a change in conditions makes it necessary.

Substituting

$$k_1 = \frac{100g}{p}\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right) \quad (8)$$

$$k_2 = \left(G+T\right)\left(1+\frac{d}{100}\right)\left(1+\frac{t}{100}\right) \quad (9)$$

$$k_3 = \left(S+D\right)\left(1+\frac{d}{100}\right) \quad (10)$$

we have

$$I = k_1(L_oh_o + L_1h_1 + L_2h_2 + \ldots . L_nh_n) + (k_2+k_3)L_1 \quad (11)$$

This general formula may be expressed directly in terms of kilowatt rating and the differences in efficiencies of the units being compared.

Let

W = kilowatt rating of the apparatus
$l_1, l_2, \ldots l_n$ = load, expressed as a fraction of full load, at which the comparison is to be made.
$e_1, e_2, \ldots e_n$ = differences between the efficiencies of the units, at loads $l_1, l_2, \ldots . l_n$, respectively, in per cent.

Then

$$L_1 = \frac{We_1l_1}{100}, L_2 = \frac{We_2l_2}{100} \ldots L_n = \frac{We_nl_n}{100}$$

and formula (11) takes the form

$$I = k_1\left(L_oh_o + \frac{We_1l_1h_1}{100} + \frac{We_2l_2h_2}{100} + \ldots . \frac{We_nl_nh_n}{100}\right) + (k_2+k_3)\frac{We_1l_1}{100} \quad (12)$$

As an illustration, let us take the simple case of a transformer in a substation. Assume that a study has been made of its probable duty, and that we are to consider the transformer as operating at three-fourth load for 3,200 hours. Since it is never operative at no load, and since the problem of distribution does not enter into this case, we have $L_o = 0$, $h_o = 0$, $D = 0$, $d = 0$.

Giving p, G, T, S, t and g arbitrary values, for the sake of illustration, let us say that $p = 8$, $G = 110$, $T = 40$, $S = 20$, $t = 6$, $g = 0.007$, $l_1 = 1$ (full load), $l_2 = \frac{3}{4}$ (three-quarters load), $l_3\ l_4, \ldots . l_n = 0$, $h_1 = 0$, $h_2 = 3{,}200$.

Applying these values in equations (8), (9) and (10), we have $k_1 = 0.09275$, $k_2 = 159$, $k_3 = 20$, and for this particular case formula (12) reduces to

$$I = 2.23We_2 + 1.79We_1$$

Suppose that two 3,000-kw. competitive power trans-

formers, "A" and "B," are to be compared, and that the guaranteed efficiencies are as follows:

	Efficiency at ¾ Load	Efficiency at Full Load
A	98.76	98.77
B	98.65	98.78
A-B	+0.11	—0.01

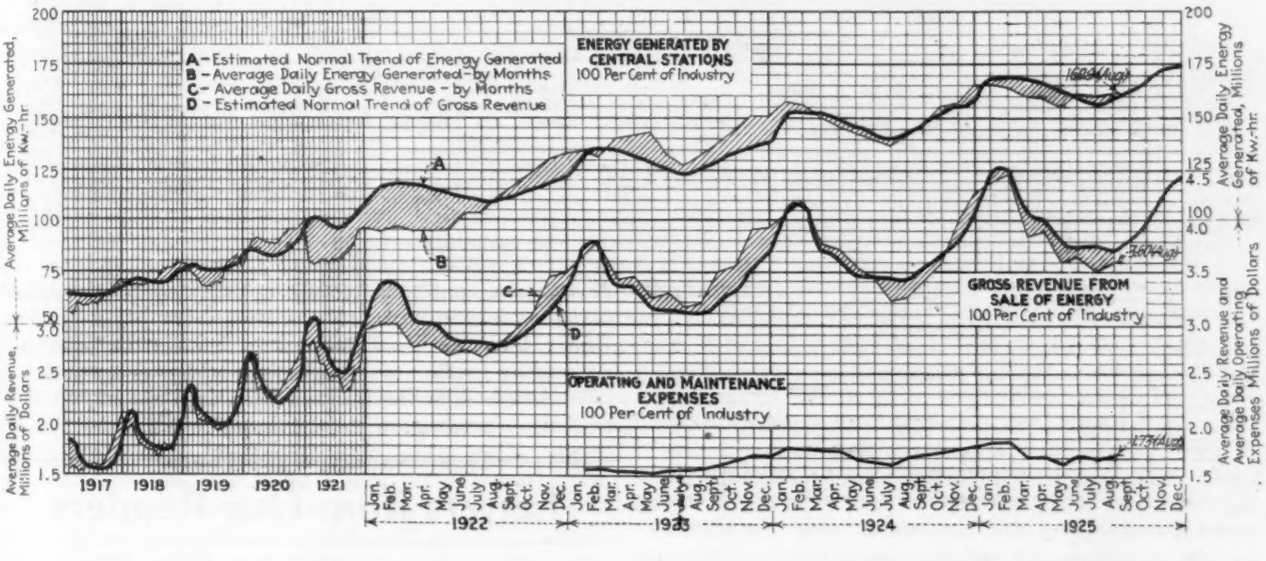
Then $W = 3{,}000$, $e_2 = +0.11$, $e_1 = -0.01$, and $I = 2.23\ (3{,}000)\ (+0.11) + 1.79\ (3{,}000)\ (-0.01) = 735.90 - 53.70 = 682.20$.

That is, we can afford to pay approximately $680 more for transformer "A" than we could for transformer "B."

In the case of distribution transformers, the no-load losses ($L_o h_o$), losses in distributing circuits (d), and cost of distributing circuits (D), must be taken into consideration.

The method is, of course, applicable to other types of apparatus such as, for example, rotary converters and motor-generators.

August Output 1.2 per Cent Above Normal


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – by Months
C – Average Daily Gross Revenue – by Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1917 1918 1919 1920 1921
1922 1923 1924 1925

CENTRAL-STATION operations during the month of August were 13.7 per cent over August of last year. This percentage gain is under that reported for June and July but materially above the average for the first half of the year. The output of 4,989,519,000 kw.-hr. during August was 1.2 per cent above the estimated normal for that month, this normal being based on the operations of the past five years. The output of the industry was below the estimated normal for the first six months of the year, but during July and August was above the estimated normal for those months.

The gross revenue from the sale of energy during August was $111,500,000, which was 3.2 per cent under the estimated normal for the month. The revenue of the industry has been below the estimated normal since the opening of the year. These figures would seem to indicate that the high-revenue domestic load has not been increasing during the present year at so rapid a rate as in past years. This conclusion is borne out by reports received on the number of domestic customers added to the central-station lines during the first nine months of the year. These reports indicate a material decrease in new domestic customers added to the lines during the present year as compared with such customers added during 1923 and 1924.

Of the total revenue, it is estimated that during August $73,308,000, or 65.7 per cent, was received from lighting customers; $26,720,000, or 24 per cent, from power customers; $4,122,000, or 3.7 per cent, from electric railways, and $7,350,000, or 6.6 per cent, from other utilities.

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
June	4,829,035	4,194,991	15.2	3,896,035	3,384,991	1,067,000	998,000	2,306,035	1,881,991	523,000	505,000	933,000	810,000	777,000	697,700
July	4,967,215	4,255,763	16.5	4,010,215	3,434,763	1,079,000	1,008,000	2,385,215	1,899,763	546,000	527,000	957,000	821,000	829,000	704,000
Aug.	4,989,519	4,382,302	13.7	4,025,519	3,535,302	1,123,000	1,050,000	2,356,519	1,958,302	546,000	527,000	964,000	847,000	841,000	729,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
June.....	$109,400	$99,700	9.8	$71,330	$67,010	$26,800	$22,140	$4,050	$4,080	$7,220	$6,470	$51,700	$47,600
July.....	109,200	95,200	14.7	70,685	64,090	27,170	20,650	4,145	4,090	7,200	6,370	50,200	45,500
Aug.....	111,500	95,400	16.9	73,308	67,000	26,720	17,850	4,122	4,110	7,350	6,440	53,600	48,750

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

TABLE III—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES||
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Short Tons	1924 Short Tons	Per Cent Increase	1925 Barrels	1924 Barrels	Per Cent Increase	1925 Thousands of Cubic Feet	1924 Thousands of Cubic Feet	Per Cent Increase
June.....	1,810,908	1,671,418	8.3	3,018,127	2,523,573	19.4	2,704,974	2,295,124	17.7	755,692	1,302,703	—41.8	3,667,081	4,176,288	—12.2
July.....	1,835,022	1,579,633	16.2	3,132,193	2,676,130	17.0	2,772,270	2,403,265	15.2	815,149	1,370,199	—40.5	4,180,741	4,959,046	—15.6
August....	1,697,338	1,491,516	13.6	3,292,181	2,890,786	13.8	2,941,988	2,565,167	14.5	704,285	1,461,238	—51.8	4,748,026	5,282,281	—10.2

|| As collected by United States Geological Survey. The data are for the electric light and power industry only.

TABLE IV—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1925	1924	1925	1924	1925	1924
June.....	52.1	52.1	28.8	25.4	43.4	46.0
July.....	52.7	53.4	26.8	27.8	54.1	46.0
Aug.....	51.2	54.8	31.4	33.0	51.1	45.0

A very significant trend is pictured in the largely increased amount of energy which is being sold by generating companies to other utilities for resale. In August this figure totaled 841,000,000 kw.-hr., while in August of last year it totaled 729,000,000 kw.-hr., a gain of 112,000,000 kw.-hr., or 15.2 per cent, during the twelve-month period. This is a direct reflection of the nation-wide trend toward interconnection and the centralization of control in the industry.

Doubts Now Cast on Economy of Swiss Rail Electrification

AS LONG as coal was high in price in Switzerland, opinion in favor of the rapid electrification of the State railroads was naturally strong. Since the war the price of coal has steadily decreased, according to a report made to the Department of Commerce at Washington by Commercial Attaché C. L. Jones at Paris, and it is now debatable whether it is cheaper to operate the railroads by steam locomotives or by hydro-electric power. The railroad administration has maintained that so long as the price of coal remains at 50 francs or more per ton electric operation is more economical, and an official report of June, 1924, stated that if the traffic of railroads increases 20 per cent, electric operation will continue to be cheaper than steam until coal prices fall to 37 francs per ton.

The actual average price paid for fuel in 1923 and 1924 was 53.11 Swiss francs for coal and 64.43 Swiss francs for briquets, delivered at the border. Coal prices have continued to fall in 1925 and now stand at about 49 francs, with probabilities of further decreases. Under these circumstances, with heavy fixed charges, decreasing traffic and high freight and passenger rates, it is obvious that the demand for a revision of the electrification program will receive increasing support.

Letters from Our Readers

Electric Utilities Will Not Find Ice Business a Gold Mine

To the Editor of the ELECTRICAL WORLD:

I have read with much interest the article "Manufactured Ice—An Opportunity," by A. J. Authenreith, vice-president Middle West Utilities Company, Chicago, appearing in your issue of October 17. I feel called upon, in the interest of all concerned, to try to dull somewhat the glistening splendor of the golden opportunity for the electric industry and the ice manufacturer which is put forward in this article, lest some one, assuming the results of electrification as given in this article to be average ones, go ahead and electrify his plant only to be very much disappointed in the economies secured as compared with those set forth.

I do not wish in any way to question the facts set forth by Mr. Authenreith, but I do wish to emphasize that they represent extreme cases and that deductions as to possible savings due to electrification based on these facts are misleading.

In the first place, the article states that the electric power consumption per ton of ice manufactured is 64 kw.-hr. and proceeds to paint a glowing picture of the possibilities here for developing a very profitable class of central-station business based on a power consumption of this amount. As an actual fact, the average power consumption per ton of ice manufactured in 1922 in electrically driven plants was 62 kw.-hr., or virtually the figure given. However, this is a much higher unit power consumption than should exist, and a properly

designed electrically driven ice plant should manufacture ice with a power consumption of 40 kw.-hr. per ton or less, depending on the temperature of the cooling water available for the ammonia condensers. The preceding refers to a new plant, but an old plant properly electrified and efficiently operated should not show a power consumption per ton of over 50 kw.-hr.

From this it is seen that prospective power consumption and central-station revenue from this class of business, estimated on the basis of 64 kw.-hr. per ton of ice manufactured, would give results much higher than would actually be obtained from plants electrified or built new in the future. The ice industry does offer to the central station an excellent class of load, being especially attractive on account of its high daily load factor, virtually 100 per cent during the summer months. But it is no such El Dorado for the power company as the article in question would lead one to believe, and it has one great disadvantage in the fact that it is a seasonal business and produces little or no revenue during six months of the year.

Turning to the ice manufacturer's side of the case, the examples cited in the article to show the great economies to be derived from electric drive are extreme cases and as such are apt to be misleading. In fact, any plant reducing its production cost through change to electric drive by any such amount as 70 per cent must have been in a fearful state of decrepitude and grossly mismanaged prior to the change. It is believed that the greater part of the saving in such a case should be credited to better management, rather than to any phenomenal inherent superiority of electric drive as compared with steam drive. As a rule, the labor saving in changing from steam drive to electric drive consists in eliminating boiler-room labor, which in plants up to 100 tons capacity means one fireman. In the cases given the plants are all very small, being of only 30 tons capacity, and the saving per ton from the elimination of such a man in this case is about three times as great as it would be for a 100-ton plant.

One of the cases given shows a reduction in labor cost per ton from $2.08 to 90 cents. This would seem to indicate the elimination of two or possibly three men per shift, and as such is a most unusual case in a small plant. The figures given are not in any way questioned, but it is wished to emphasize that they represent extreme cases and not average cases and that the average ice plant at present utilizing steam drive need expect to achieve no such economies as those given by changing over to electric drive. The economies which can be secured by such a change vary with local conditions and the type of equipment in the individual plant, but it is only in most exceptional cases that they attain the magnitude of those quoted.

Undoubtedly electric drive is the best ice-plant drive. It is so, not so much on account of somewhat lower first cost and operating cost, but because of its greater simplicity, dependability and cleanliness, these factors in the aggregate far outweighing the economies derived. In fact, were there no economy, the refrigerating engineer would still continue to recommend electric drive in preference to either steam or oil engine. Where power rates for this class of service do not exceed 1¾ cents per kilowatt-hour, the electric drive shows a saving on power cost; and the smaller the plant, as a rule, the greater the saving per ton of ice. For ice plants of capacities of 100 tons of ice or more the difference in both first cost and unit production cost between plants of modern design equipped with the three types of drive — synchronous motors, uniflow steam engines and full-Diesel oil engines—is not so great as is believed by many to be the case. Assuming three 100-ton plants so equipped, a power rate of 1¼ cents per kilowatt-hour, coal at $5 a ton and oil at 6 cents per gallon, and taking the costs for the electrically driven plant as 100 per cent in each case, we find for the uniflow-steam-engine-driven plant a relative investment cost of 118 per cent and a unit production cost of 111 per cent. For the full-Diesel-oil-engine-driven plant there is a relative investment cost of 109 per cent and a unit production cost of 106 per cent. The unit production costs in each case include reserve for depreciation and interest on the investment. If these overhead items are eliminated, the full-Diesel-engine-driven plant shows much the best operating economy. However, the higher depreciation and interest charges against this type of plant more than offset its saving through low fuel cost.

The article under discussion also states that in electrifying an existing compressor-type ice plant it is usually necessary to buy new compressors. As a fact, it is rarely necessary or advisable to scrap the old compressors, since the ammonia compressors of present-day manufacture are not a sufficient improvement over those of ten to twenty years ago to justify any one in scrapping serviceable equipment. An excellent rule in such cases is not to make any change where the savings to be reasonably expected do not equal at least 15 per cent per year on the investment required to make the change. It is usually very easy to change over a steam-driven to an electrically driven plant and to do this at quite a nominal cost. Except for very large compressor units, it is usually cheaper to use a slip-ring induction motor belt connected to the compressor, rather than a directly connected synchronous motor. The reason for this is that most ammonia compressors built for steam drive are low-speed machines. The cost of a synchronous motor suitable for direct connection to a machine of this type and the expense of installing usually bring the cost of making this change as compared with a belt drive from a slip-ring induction motor to the point where the additional cost more than offsets the advantages of the synchronous-motor drive. In new compressor installations where the compressors are as large as 30 tons of refrigeration the direct-connected synchronous-motor drive is to be preferred, and it is at this time being almost exclusively installed.

In conclusion, it is wished to restate the fact that the preceding is not in any wise to be considered as an effort to discredit the facts as given in the article under discussion, but is prompted by a desire to prevent any one deducing erroneous conclusions from these facts on the assumption that they represent average cases. It is felt that propaganda of this kind, while well intended and prompted by enthusiasm for the power industry, is dangerous to the best interests of both the central station and the ice industry; that it is much better to give on such matters conservative figures which can be attained in the average case and are consequently not liable to mislead.

HARRISON D. PANTON,
Consulting Engineer.
Raleigh, N. C.

Central Station and Industrial Practice

Use of Reactive Meters and Graphs to Determine Power Factor

BY O. N. HANSEN
Electrical Foreman Hudson Avenue Station, Brooklyn Edison Company

INSTEAD of power factor meters on the generators, the Hudson Avenue station of the Brooklyn Edison Company is equipped with an indicating reactive meter mounted

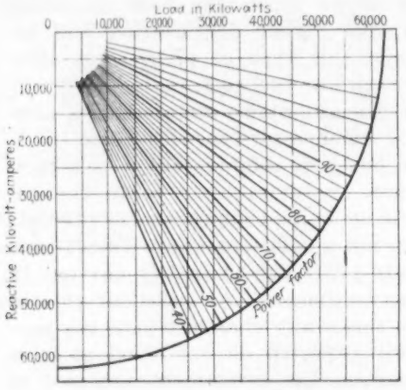


CHART FOR DETERMINING POWER FACTOR FROM REACTIVE KILOVOLT-AMPERES AND KILOWATTS

alongside of the kilowatt meter on each generator panel, and a totalizing graph-drawing reactive meter mounted adjacent to a graph-drawing totalizing wattmeter, the latter two instruments giving the summation of the kilowatts and reactive kilovolt-amperes of the main units.

Charts have been prepared, one of which is reproduced herewith, from which the power factor may be determined from the simultaneous readings of kilowatts and reactive kilovolt-amperes. The horizontal scale is kilowatts, the vertical scale is reactive kilovolt-amperes, both scales reading from the upper left-hand corner of the chart. The power factor lines radiate from this point and it is obvious that on the intersection of any two given kilowatt and reactive kilovolt-ampere readings the desired power factor will be found. By the use of the reactive meter and the charts a more accurate power factor determination can be made than by the use of power factor meters, either single phase or polyphase.

The system operators of the Brooklyn Edison Company control the output and distribution of power from the three generating stations of this system, which are all tied together. With the exception of Hudson Avenue, other substations are equipped with power factor indicators.

By aid of the charts the operators quickly convert reactive kilovolt-amperes into terms of power factor or vice versa, thereby greatly aiding the system operator in the proper distribution of the reactive load on the different stations of the system.

It is quite probable that where stations and machines are run at constant loads the use of "power factor" may diminish in favor of reactive loading, but where the load of machines and generating stations that are tied together has periods of rapid fluctuation both in load and in "power factor," the use of "power factor" is the most direct and the simplest method of properly assigning the reactive component to the different generating stations and machines by the system operators and station operators.

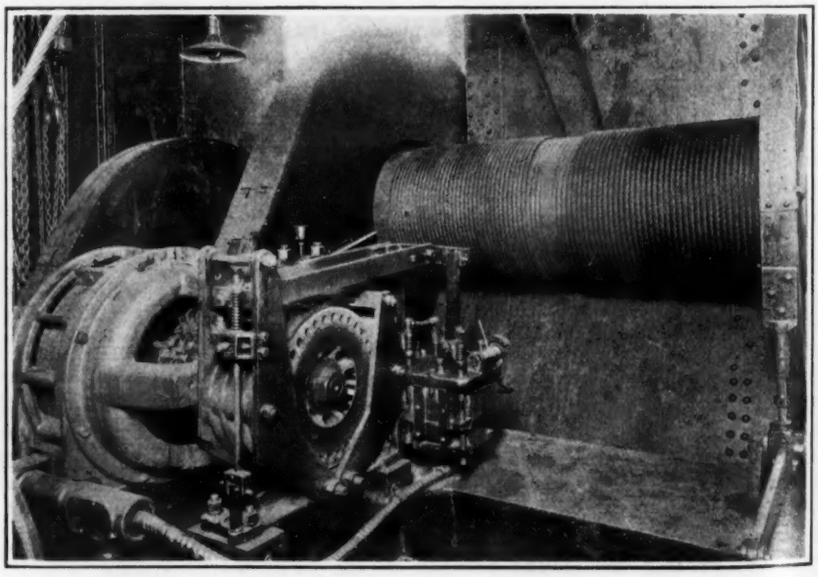
Electrically Operated Cranes for Cargo Handling

TWO electrically operated cranes were recently installed at one of the New York Central Railroad piers in Weehawken, N. J. This pier is used almost exclusively for handling boxed automobiles for export shipment. The cranes take crated automobiles from the flat cars and place them on lighters or distribute them on the pier awaiting the arrival of lighters, the crates being handled in slings in the usual manner. The larger of the two cranes has a 20-ton main hoist with a 5-ton auxiliary truck, the other being equipped with a 10-ton main hoist and 5-ton auxiliary.

From an electrical standpoint two interesting features are the solenoid load brakes and the special twin master controllers with pump handles. Load brakes are applied to both the large and the auxiliary hoist on each crane.

Both main and auxiliary hoists are equipped with 80-hp., 600-r.p.m. motors, geared for different speeds to allow the light hook to travel faster. Magnetic control is used for all motions on the crane except the boom hoist, the panels being built to match, making one complete control switchboard.

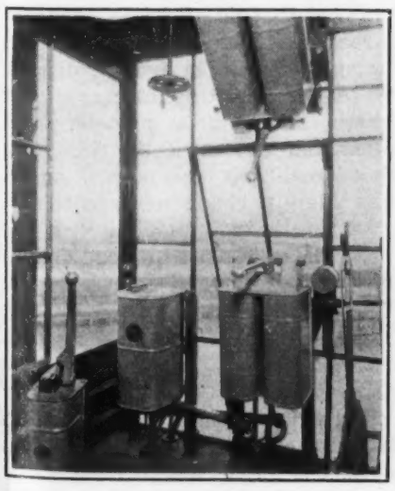
In the operator's cab are two twin controllers, one for the main hoist and the other for the auxiliary. One of each pair is a duplicate master for the swinger. When operating with the auxiliary hook, the operator can control both the raising and the



MAIN HOIST MOTOR FOR 20-TON CARGO-HANDLING CRANE

TEN AND TWENTY-TON CARGO-HANDLING CRANES ELECTRICALLY OPERATED

lowering of the hook and the swinging of the tower from one handle. When operating the main hoist he can control from the other handle the raising and lowering of the main hook and the swinging of the tower. The handle of these double-motion controllers can be moved up, down or sideways, these motions corresponding to similar motions of the cranes. Hence it is possible to throw the handle into any angle between the vertical or horizontal positions, thus operating both motors and swinging in either direction or hoisting or lowering all at the same time. Since the boom hoist is seldom used, the operator is left with but two levers to handle normally—the double master handle and the traveling master handle.



OPERATOR'S CAB OF 20-TON CRANE, SHOWING MASTER SWITCHES WITH UNIVERSAL HANDLES

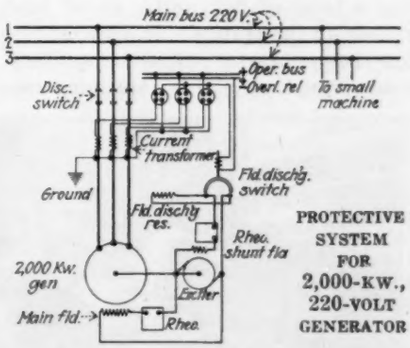
Another point of interest is the layout of the third rail system for the cranes, in order to avoid trouble from excessive voltage drop. The power circuit is three phase. The track on which the crane runs is grounded and used as one side of the three-phase circuit. By placing a standard New York Central third rail on each side of the track, the supports bring the two rails up so that, in cross-section, the three rails are equidistant and at the points of a triangle, thus giving the most desirable relative location for minimum losses. The pier is 800 ft. long and the power is tapped into the rails at short intervals all along the pier from conduit running beside the rails.

The two cranes were built by Heyl & Patterson of Pittsburgh and the electrical equipment by the General Electric Company.

Protecting Low-Voltage Generators

BY JULIUS REUTLER
Brookline, Mass.

THE protection of low-voltage three-phase generators often presents great difficulty and the recent installation of a turbo-generator with a capacity of 2,000 kw. at 220 volts in a German paper mill shows an interesting way of overcoming such difficulties. The normal current of this generator is approximately 6,600 amp. and the highest interrupting capacity of German oil circuit breakers is 4,000 amp. Two breakers in parallel would have given the required protection, but the cost of such equipment is very high and experience in putting two or more oil breakers in parallel indicated that such an installation would not give reliable service. The electrical manufacturer's engineers proposed the protective scheme shown in the accompanying diagram.



PROTECTIVE SYSTEM FOR 2,000-KW., 220-VOLT GENERATOR

Three current transformers, three single-phase relays and an electrical operated field discharge switch were installed as shown. In case of trouble a resistance is cut into the field circuit through tripping of the field discharge switch. By opening the disconnecting switches the generator can be separated from the bus. A disadvantage of this method is the impossibility of synchronizing

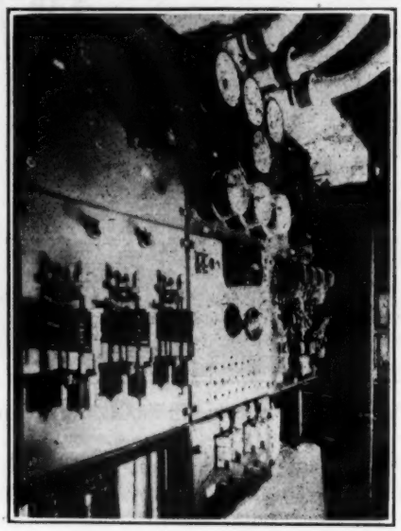
without an oil circuit breaker, but in the case described the 2,000-kw. generator carries the base load and a smaller machine is connected to the main bus through an oil circuit breaker and is synchronized.

Synchronous Motors for Dual-Driven Circulating Pumps

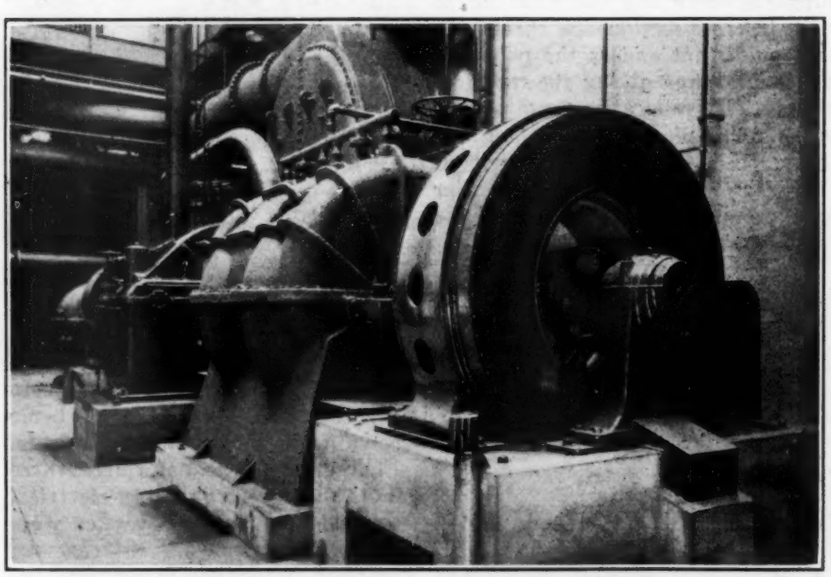
By John W. Anderson
Station Engineering Department, Philadelphia Electric Company

THE majority of motors installed in generating stations at the present time for driving station auxiliary apparatus are of the induction type. The reason for this is the fact that synchronous motor drive is entirely satisfactory for only a very few of the station auxiliaries. As a consequence, the power sources supplying the station auxiliary load must operate at a comparatively low power factor, a condition that is greatly aggravated by the necessity for operating many of the motors at reduced speed and reduced load.

The problem of improving the power factor of the station auxiliary power system at the Delaware station of the Philadelphia Electric Company was considered by that company's engineers at the beginning of the year 1923. The construction program for that year included the installation of two 30,000-kw. generating units at Delaware, making a total of five units, all of this rating, in the station. In view of the low power factor of the auxiliary load, which at this station was caused mainly by large low-speed circulating pump motors and forced and induced draft fan motors, which normally operate at reduced speeds, it was felt desirable to use synchronous motor drive for some of the auxiliaries to be installed with the two new generating units. After a careful study of the question a decision was reached to install leading power factor synchronous motors on the dual-driven circulating pumps associated with these units.



CONTROL BOARD FOR SYNCHRONOUS MOTOR OF DUAL-DRIVEN CIRCULATING PUMP



DUAL-DRIVEN CIRCULATING PUMP USING SYNCHRONOUS MOTOR

It will be noted that the semi-inclosed motor construction permits the safe inspection and oiling of motor bearings without appreciable restriction of ventilation. The push-button station from which the motor is controlled is located at the top of the vertical conduit at the motor base (the push buttons are covered to prevent accidental operation by any one chancing to brush them in passing the motor). A part of the reserve straight induction-motor-driven pump with the motor controller is visible beyond the turbine. The panels on which are mounted the automatic control equipment for the synchronous motor and for the induction motor of the reserve pump are located in a special housing just to the rear of the camera position.

Pumping equipment for circulating water at Delaware, both on the three units installed previous to 1923 and on the three units since placed in service, consists of duplicate motor-driven pumps for each generating unit, one of which is coupled to a steam turbine as well as to the motor. Only the dual-driven pump is used during regular operation of the station, the straight motor-driven pump operating in emergencies or occasionally during hot summer weather. The purpose of the dual-driven pump as installed at Delaware is twofold: first, it provides a very reliable supply of circulating water, as on failure of either the motor or the turbine or their respective supplies the opposite drive is available to continue the pump in service; and second, it provides the means of maintaining station heat balance. This latter feature is obtained by automatic equipment, which operates a motor-driven governor on the pump turbine to vary the proportion of the pump load carried on the turbine and thereby give the proper quantity of exhaust steam for heating feed water.

For the first three generating units installed at Delaware, the requirements of both the dual-driven and straight motor-driven circulating pumps were taken care of in a satisfactory manner by the wound rotor induction motors mentioned previously. These motors are of very sturdy construction; their control is simple and rugged, and is so arranged that no attention whatever is required from station attendants during abnormal system conditions, the motor shutting down if the voltage drops to a predetermined value, and automatically restarting when conditions are normal again. In deciding to change to synchronous drive for the new units, it was the aim to make the synchronous motors and their control comparable to the existing induction motor equipment.

As installed for the two generators placed in service in 1923 and also for the sixth 30,000-kw. generator in 1924 (which brought the station to its designed capacity), the electrical equipment for the dual-driven pumps consists of push-button controlled synchronous motors together with the necessary automatic control and

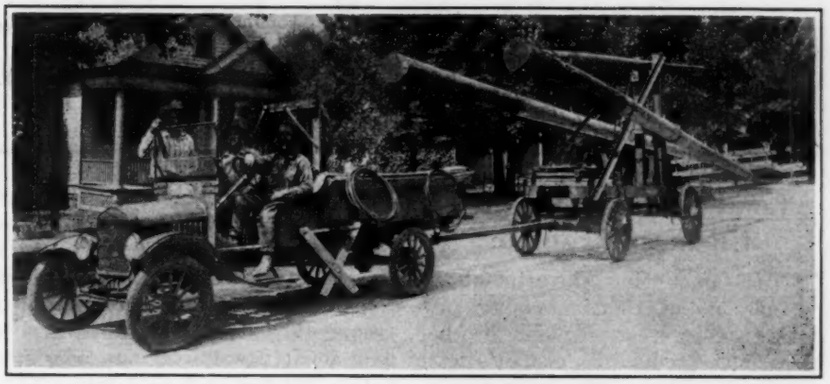
protective equipment. The motors are rated as follows: 400 hp., 474 kva., 2,400 volts, three phase, 60 cycles, 300 r.p.m., 70 per cent power factor leading. However, in view of the fact that the motor is rarely called upon to carry the entire pump load and the field excitation is always maintained at rated value, the motor usually operates at lower than 70 per cent power factor, with a consequent additional raising of the station auxiliary load power factor.

The synchronous motors are started on full voltage. During preliminary tests on the first of these motors to be installed, compensator starting was used. However, although this method kept the starting kilovolt-amperes at a minimum, it was found that the motor, and in fact the entire set, was subjected to very severe mechanical shocks when the starting voltage was removed and full voltage applied. In order to improve this very undesirable condition, starting at full voltage was tried at the suggestion of the manufacturer and was found to be much less severe than compensator starting.

The control for these motors is so arranged that their operating features duplicate those of the induction motors. The synchronous motors stay on the line under system disturbances as long as the supply voltage is above pull-out voltage; but if a motor has been automatically disconnected from its supply for any reason except internal failure, it automatically restarts when conditions have again become approximately normal, the turbine having in the meantime kept the pump in operation.

The control for the synchronous motors is of course quite different from that for the induction motors, because of the inherent differences in the two motor types. As an example of the effect of these differences, there is the fact that the synchronous motors become small turbogenerators under certain conditions. For instance, in the event of the accidental opening of an oil circuit breaker in the motor supply, the voltage on alternating-current contactors or relays does not become zero, but on the contrary may rise above normal value because of the overexcitation on the motor; and should the switch be reclosed, it is very likely that motor and supply would be reconnected out of phase.

These operating features and adequate protection for the motors under all likely abnormal conditions were obtained by a combination of control and protective relays, which will be treated in a subsequent article.



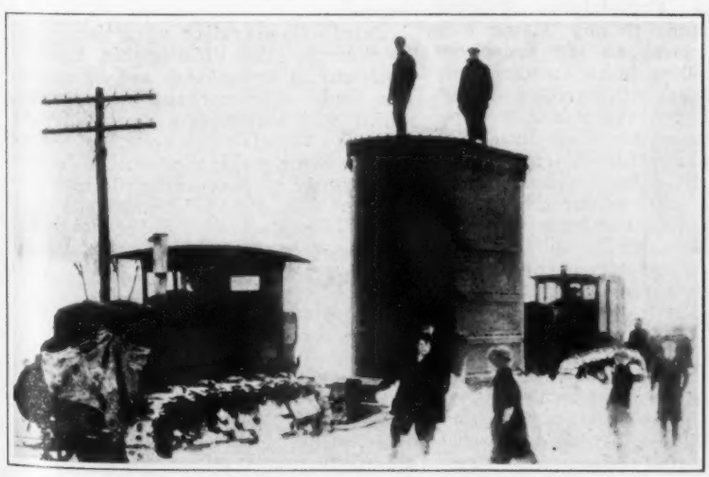
POLE DERRICK OPERATED BY THREE MEN USED BY MONTANA POWER COMPANY

Inexpensive Pole Derrick for Small Towns

IN SMALL towns of only a few thousand population, where poles are set infrequently, there is always the problem of finding an inexpensive method of erecting poles and one requiring the fewest possible men. In Livingston, Mont., the Montana Power Company uses a combination pole truck and derrick.

This consists of an old wagon running gear which cost $35 on which has been mounted a gin pole and winch costing an additional $35. It is seldom that extensions of more than two poles are made, and in such cases the poles with the crossarms mounted on them are slung from the derrick and hauled to the job by a Ford truck in the manner shown. A hand winch on the derrick is used for raising the poles, although the truck might be used for this purpose by providing the gin pole with a block and tackle.

Difficulties in Moving Transformers



SOME of the difficulties in moving a 20,000-kva., 110,000-volt auto transformer in winter are illustrated in the above views. The substation was three miles from the railroad, the highway traverses several hills and a bridge, the transformer weighed 67 tons, and the temperature varied greatly. A bridge had to be strengthened. The transformer was loaded on a specially constructed sled pulled by a 10-ton tractor assisted by an auxiliary winch and the work of transporting the transformer to the substation was accomplished in nine hours.

Commercial Activities and Public Relations

Load Factor a National Business Problem

THE mounting investment in plant and the increasing proportion of interest on plant to other costs in producing energy were re-emphasized recently by John Gilchrist, vice-president of the Commonwealth Edison Company, in addressing a group of utility men in the Great Lakes district. High prices keep on, he pointed out, with no indication that we are not on a permanently higher level, and perhaps 60 to 70 per cent of the existing systems have been built in the era of high prices. The money is spent and the necessity of making a return on it will go on to retirement. To offset the fixed charges more kilowatt-hours must be sold with existing kilowatts of capacity. The old questions of load factor and power factor arise more prominently than ever. For example, if the load factor can be increased from 50 per cent to 75 per cent the interest charge per dollar of income goes down 33⅓ per cent.

To what extent are we really specializing or concentrating on improvement of load factor, Mr. Gilchrist asked? It is a universal problem, applicable not only to utilities but to all business. Human habits that are not necessarily the best thing for the race frequently produce poor load factors, crowding facilities and requiring a maximum of service and labor at one time, with corresponding periods of idleness, low production and low earnings at other times. The request of the post office for the public to assist in producing a better load factor is just one example. The attention which the National Association of Commerce is giving the subject indicates its universal existence.

If people can be offered inducements, continued Mr. Gilchrist, that will prompt them to submit to organization for the general good, and if concerted action on the part of some group can be engineered that will start the movement, the benefits will be far reaching. Little hope can be entertained for changing the load factor of restaurants or eating houses; nevertheless, the advantages are obvious. Changing the starting times of businesses would not be so difficult to deal with. Large institutions that have an elevator problem or lunchroom problem frequently vary the hours of arrival and departure in various offices to flatten out the peak and improve the load factor. Local merchants have their peak problems, and there are many cases in all businesses of monthly and annual, if not daily, peaks which through co-operation might be worked out.

What is needed, concluded Mr. Gilchrist, is some incentive—premiums for suggestions or the like—which will make every one keenly interested devising ways of improving load factor in its broadest sense, not just the technical factor applied to mechanical or electrical operation.

Joint Merchandising for Philadelphia

Central-Station Company Agrees to Take Over and Finance Electrical Dealers' Appliance Sales—Commissions to Be Paid on Various Campaign Activities

A PLAN whereby electrical contractors, dealers and jobbers may join with the Philadelphia Electric Company in a broad co-operative merchandising and advertising program has been announced by C. J. Russell, vice-president of that company. Under the plan the Philadelphia Electric offers to take over contracts made by accredited contractor-dealers and collect from the customer the amount of the contracts on the deferred-payment basis. The Electric Club will be sponsor for the contractor, and the company will finance the payments. The proposed plan, which embraces three main points, was outlined by Mr. Russell as follows:

THE CO-OPERATIVE PLAN

First — The Philadelphia Electric Company extends to any wiring contractor who wires an old house the privilege of selling to his customer any electric appliance of standard or approved make upon the standard terms and conditions of our lease forms for this type of apparatus during a period of one year after the residence wired has been connected to our circuits.

We will provide the lease forms to the contractor, which he will have the customer sign and which, after such lease has been approved for credit by this company, will be taken over by this company and collections of the deferred payments made by us—the list price of the appliance being paid by us to the contractor after the second installment has been paid by the customer. Conditions attached to such sales are few but important. These sales must be made at list prices plus a small carrying charge, according to schedules which will be provided. The contractor may make his own arrangements with the jobber, and the profit to him will be the difference between the list price and the jobber's price.

Second—The various campaigns on appliances conducted by the Philadelphia Electric Company each month for definite periods (other than clearance sales) may be participated in by the contractor-dealer in the following manner:

The contractor-dealer may sell to any of his customers the appliance being campaigned, according to the terms and conditions of such campaigns, on the lease forms of this company which will be furnished by us. The sale must be approved for credit before acceptance by this company, and when the sale has been accepted a commission of approximately 15 per cent will be paid the contractor-dealer by us.

The advertising, either in newspapers or by broadside mailed to our customers, will contain the information that during the campaign the particular appliances may be purchased from the local dealer or from this company.

Third—Co-operative advertising will be done by the Philadelphia Electric Company in newspapers and by streetcar cards, with perhaps other media, which will feature the desirability of the use of electric labor-saving devices in the home, calling attention to the opportunity of purchasing all such appliances from the customer's local electric dealer, such advertising not bearing the imprint of this company.

A REAL SALES HELP TO DEALERS

This plan is obviously fitted for the sale of the larger and more important devices. Some of the smaller appliances, such as the electric iron, will not be included, for the reason that the dealer can readily make cash sales of the iron at probably lower prices than this company is selling irons, and the expense of collection upon irons sold on the deferred-payment plan would be prohibitive if such expenses were to be assumed by this company.

It is felt that the above co-operative

plan offers a very real sales help to the contractor, the dealer and the jobber, and that it should be of material benefit to both the wholesale and retail electrical industry in this city.

Eleven Tests of a Good Utility Security

AS A GUIDE for the ever-increasing number of utility-security purchasers, a large investment house has recently drawn up a group of eleven tests for a utility bond. These tests have been accepted as both inclusive and fair, and are as follows:

1. The company's right to operate its property should extend beyond the life of the bond, or should be indeterminate.

2. The utility should be free from competition.

3. The company should have satisfactory public relations and competent management.

4. It should have customer-ownership of its preferred stock.

5. The territory served should be prosperous and growing both in population and in industry.

6. Earnings should show an increase in gross and net for a period of years.

7. Interest charges should be earned twice before depreciation.

8. Bonded debt should not exceed 80 per cent of property value.

9. Bonded debt should not exceed five times gross earnings.

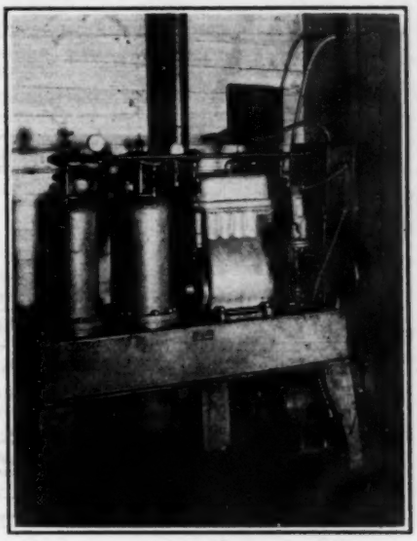
10. Property should be adequately maintained with combined maintenance and depreciation less than 12 per cent of gross earnings.

11. The company's main vehicle of financing should be a modern mortgage with issuance of additional bonds restricted to 80 per cent of the cost of additions to property and allowable only when interest charges are earned twice.

Refrigeration Returns $3 per Capita

Wisconsin Town Has Twenty-five Commercial Installations, Totaling 410 Hp., Producing $15,000 Annual Revenue —Small Units Being Developed

COMMERCIAL electric refrigeration in Monroe, Wis., center of the dairy and cheese industry of the state, has been developed by the Wisconsin Power & Light Company to a point where this class of business returns an annual income of $3 per capita. Monroe is a town of 4,777 population and the twenty-five refrigerator installations consume 257,437 kw.-hr. annually. The accompanying table shows the distribution of refrigeration load and energy consumption according to the following classification of customers: Cheese storage, cream plants, dairies, meat markets and hotels.



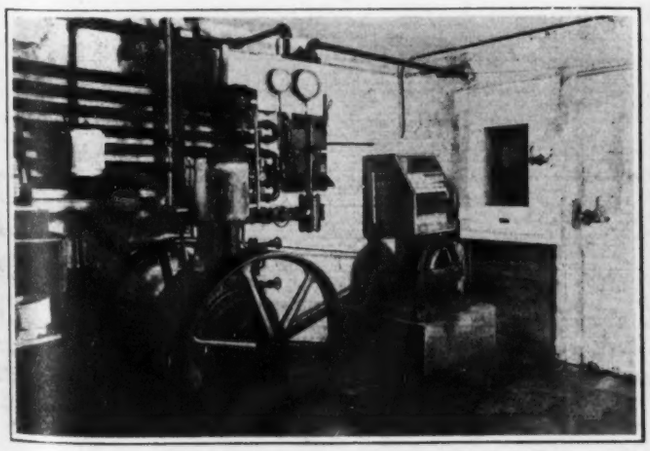
ELECTRICALLY DRIVEN REFRIGERATOR IN A CHEESE FACTORY

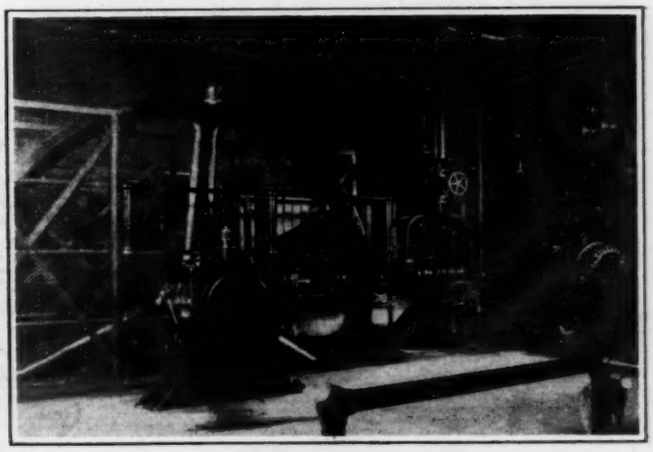
This refrigeration load has been built up by co-operation of the central station with manufacturers' agents. Domestic machines, which are increasing in number, are handled by the utility, but all commercial business, including the servicing of machines, is handled by the manufacturers' agents.

But little natural ice is available in Monroe, and W. F. Turner, district manager of the Wisconsin Power & Light Company, believes that this condition, together with the cost of $6.75 per 1,000 lb. for

ELECTRIC REFRIGERATION INSTALLATIONS, MONROE, WIS. (POPULATION 4,777)

	Cheese Storage	Cream Plants	Dairies	Markets	Hotels	Total
Number	5	2	3	11	4	25
Total horsepower	190	95	77	48	9	410
Monthly Energy Consumption, Kw.-Hr., 1924						
January	5,560	696	1,087	1,757	306	9,405
February	4,080	911	1,030	1,927	288	8,236
March	4,510	870	1,306	1,713	232	8,631
April	6,330	1,159	1,586	2,163	651	11,889
May	10,370	2,014	1,823	2,390	629	17,226
June	15,130	5,980	2,106	3,276	657	27,149
July	19,730	7,159	2,132	3,935	766	33,722
August	24,060	4,361	2,461	4,750	974	36,606
September	20,930	9,169	2,481	4,288	714	37,582
October	16,820	4,347	2,167	3,565	562	27,461
November	14,680	4,256	1,802	3,137	760	24,635
December	6,310	4,879	995	2,078	633	14,895
Total	148,510	45,800	20,976	34,979	7,172	257,437



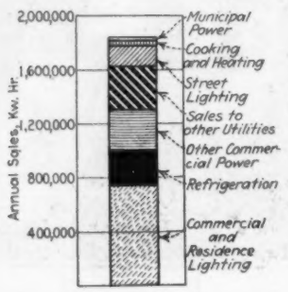


TYPICAL ELECTRIC REFRIGERATING INSTALLATIONS LOCATED IN MEAT MARKET AND ICE PLANT ON LINES OF THE WISCONSIN POWER & LIGHT COMPANY

ice, has helped sell electric refrigeration. However, besides these considerations, electric refrigeration has a particular advantage in the cheese industries, where constant temperature is highly desirable, a condition impossible to maintain when ice is used.

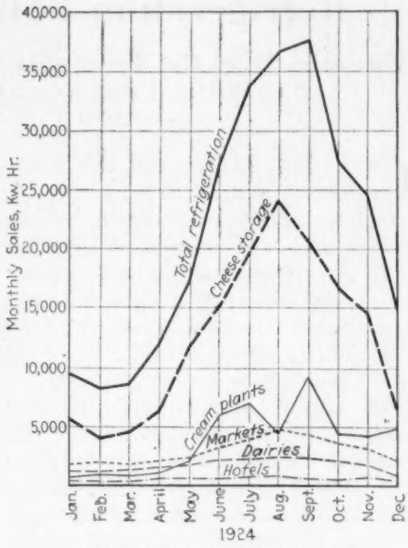
ICE BILL $200, ELECTRIC BILL $35

A confectionery store formerly using ice at a cost of $200 per month installed an electric refrigeration unit and was able to do the same work with an electric bill of only $35. In addition to this, the ice cream was kept in a better condition and considerable saving was made in the cost of handling ice cream tubs. Because of the economies to be effected with electric refrigeration, an ice cream and cold storage company has recently converted it steam equipment to electric drive and during the first month's operation used 20,000 kw.-hr.



RELATIVE IMPORTANCE OF ELECTRICAL REFRIGERATION AND OTHER LOADS

Electric refrigeration is the best available load for a central station, in the opinion of Mr. Turner. Experience in Monroe shows that the commercial machines operate twelve hours per day during the summer months, with power bills ranging up to $400 per month. So actively has this load been developed that it produces $15,000 in annual revenue and has noticeably improved the district's annual load factor. All meat markets and practically all hotels are users of electric refrigeration. The total connected load of commercial units is 410 hp.



ENERGY CONSUMPTION BY MONTHS FROM REFRIGERATING LOAD

Electric Ranges Shown to Be Inexpensive

TO PENETRATE the sales resistance to electric ranges imposed by the thought that they are expensive, the Washington Water Power Company, Spokane, in a recent campaign on the Junior Cabinet Westinghouse range, featured in its advertising the fact that an electric range costs no more than a good fuel range. To bring out this point all the campaign advertising was made to carry an itemization of the total price of the installed electric kitchen, including range, water heater and boiler cover. The idea back of this advertising was that the prospect is inclined to think in terms of an electric range alone, not realizing the other elements entering into a change from a fuel kitchen to an all-electric one. It was thought that the displayed price of $189 for the complete job, without additional explanation, would tend to cenfirm in the mind of the prospect a perhaps preconceived conviction that electric ranges are too expensive. Thus in all advertising the following explanation of the total price of the electric kitchen was made:

AN ELECTRIC RANGE AT THE SAME PRICE AS A GOOD FUEL RANGE

In this sale we present you with a complete electric kitchen, including electric water heater—ready to use—at $4 down.

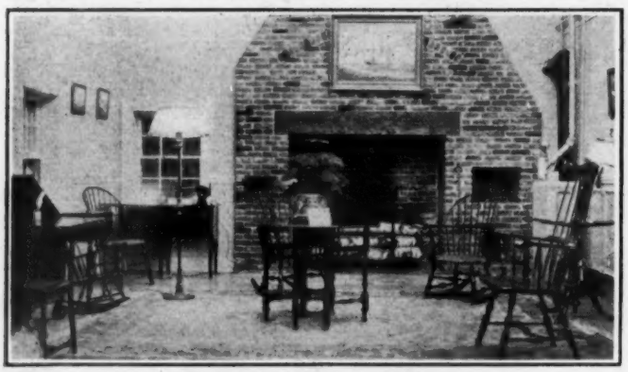
Here is the classification of all the items that go into a complete electric kitchen showing you the price of each separately:

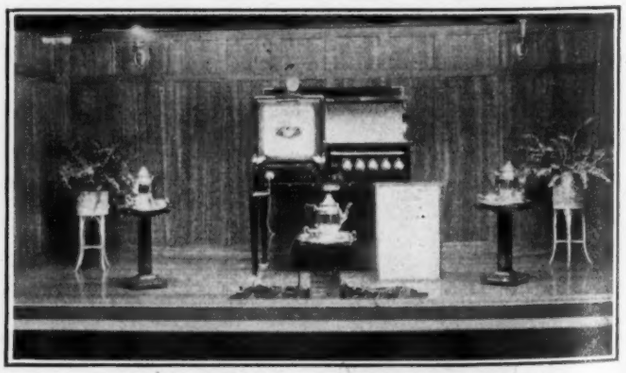
Junior Cabinet Westinghouse Electric range	$129
Range and water heater wiring	40
Electric water heater	10
Fiberform cover for water tank	10
Total price for a complete electric kitchen	$189

The price of the electric range alone, $129, does not appear high and compares favorably with that of a good fuel range.

R. B. McElroy, assistant sales manager, handling the campaign, stated that this advertising had been effective in paving the way for the salesman by overcoming one of the customer's chief objections.

Utility's Salesroom as Meeting Place for Civic Associations





FRIENDLY public relations are engendered by the Connecticut Power Company through its hospitality to local organizations in New London at its appliance display cottage. The cozy interior shown in the left-hand view is thrown open free of charge for meetings and gatherings of all sorts, and the window displays, as shown at the right, are most effective in their appeal on behalf of a wider use of electric service.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Review of Steam-Turbine Development.—HANS DAHLSTRAND.—This paper is chiefly concerned with the effects which the use of steam at higher pressures and temperatures has had upon the efficiencies of steam turbines and upon the materials used in the construction of their parts. The use of high back-pressure steam turbines, to be installed in connection with boilers of higher pressure in such a way as to exhaust into the steam mains and turbines of existing plants, is analyzed for units of 10,000-kw. and 30,000-kw. capacity, and the effects on the efficiency are graphically presented. A discussion of materials for use with the higher pressures and temperatures is included, with some curves showing the results of investigations on various metals and the characteristics which should be possessed by a metal suitable for use at 1,000 deg. F. The paper also contains comments on corrosion and erosion of turbine blades, which are illustrated by views showing the effects of these agencies on blades of different composition.—*Mechanical Engineering*, October, 1925.

Automatic Eliminators for Alluvial Matter in Water-Turbine Supplies.—Continuing the series of articles to which reference has previously been made, information is presented regarding the efficiency of a number of installations that have been in actual use for a number of years. In one of these, built to eliminate grains of 0.5 mm. diameter or larger, the quantity of grains greater than 0.4 mm. (0.016 in.) diameter in the mud of the water leaving the eliminator was only 1.55 per cent. Other similar instances are cited. In another plant the life of the parts which had previously been eroded was prolonged in the proportion of about one to three. At the same time, by reducing the erosion the efficiency of the turbines has been kept at a higher value.—*Engineering (England)*, Sept. 25, 1925.

Generation, Control, Switching and Protection

Protective Value of Lightning Cables.—R. STEIN.—Assuming that the distribution of the electric field around a transmission line is the same as the current distribution around the conductors in a homogeneous electrolyte, the author built a model of a transmission tower on the scale of one to fifty, equipped it with copper conductors and placed it in a large vat filled with acidified water. Charging the model with 1,000 cycles alternating current at 170 volts, the potential was measured all around the wires with a modified Wheatstone arrangement and was plotted on co-ordinate paper. The result was a picture of the electric field around the wires and lightning cables. Choosing one or two lightning cables and arranging the power wires and protecting cables in various ways, the amount of electric shielding was determined. The percentage of protection with two such cables was found to average only 25. This means that during a nearby lightning stroke the power line will still be subjected to three-quarters of the voltage which it would attain if no protection were used, an amount of protection which seems small in comparison with the cost of installing two such cables. The other advantage of a lightning cable, to connect and to ground all towers, can be obtained much more cheaply by a connecting cable placed under the power cables.—*Siemens Zeitschrift*, Vol. 8, 1925.

Transmission, Substations and Distribution

Power-Factor Questions in Medium-Voltage Networks.—F. PICHLER.—The author shows by several practical examples how great an improvement in the power factor of an installation can be obtained by a proper dimensioning of transformers and motors. Having agricultural service particularly in mind, it is recommended that a transformer of about 30 per cent motor capacity and a motor of only 67 per cent maximum power requirement be selected. In frequent cases the use of the much-heard-of compensated motors may not be warranted on account of various disadvantages such as much higher cost, increased maintenance and the necessity of installing two meters. The latter fact is often overlooked. The mere installation of such a motor cannot be made the basis of a reduced rate, because such a motor must not necessarily operate with unity power factor, although it can be made to. Consequently an additional wattless-current meter must be added to the customary meter to check the consumer's demand. Statistics from motor repair shops indicate that 78 per cent of motor troubles are commutator troubles. The author concludes that it would be entirely wrong to look upon the present power-factor controversy as a fad and to do nothing in the direction aimed at, but that it would be likewise wrong to go to the other extreme and establish severe rules for motor installations which would reduce the wattless current to a minimum but would introduce at the same time more expensive and less reliable motors. Rules of such a nature would hamper rather than popularize the general use of electric drive.—*Elecktrotechnik und Maschinenbau*, Sept. 20, 1925.

Rectifier Substations.—E. GEBAUER.—The Vienna (Austria) rapid transit system is supplied with 750 volts direct current from four substations, receiving 5,000-volt, three-phase current from the municipal power system. The current transformation in all these stations is accomplished by mercury-arc rectifiers of 700 kw. unit output. Two or three units are installed in every plant, making a total of ten rectifiers with a combined capacity of 7,000 kw. Without enlarging the present stations an additional 3,000 kw. can be installed. Each rectifier has its own three-phase-to-six-phase transformer. To take care of unforeseen temporary overloads beyond the capacity of the substations, one ambulant station is available, which can be readily hauled to any desired point on the system. This railroad-car substation contains a 700-kw. rotary and transformer. A special starting motor on the shaft of the converter brings it up to synchronous speed. The entire equipment was built in Vienna.—*Elektrotechnik und Maschinenbau*, Sept. 27, 1925.

Transmission Stability.—C. L. FORTESCUE.—This is an analytical discussion, in the main non-mathematical in form, of factors entering into the problem of the stability of large interconnected power systems. To get the most out of present-day designs, without awaiting possible future developments, the two most important means are given as (1) improved inherent regulation of machines and (2) increased speed of excitation. A report of the discussion on this and related papers read at the Pacific Coast Convention of the A. I. E. E. will be found in the ELECTRICAL WORLD for October 3, 1925, on page 691.—*Journal, A. I. E. E.*, September, 1925.

Units, Measurements and Instruments

Properties and Testing of Magnetic Materials.—T. SPOONER.—This, the seventh part of a serial to which references have previously been made, takes up the effect of frequency on permeability and losses. The inclusion should be mentioned of theoretically derived formulas, such as those given by Russel and Latour, for hysteresis and eddy-current losses, taking account of skin effect and involving the use of hyperbolic functions. The difficulty of applying these formulas in practice is discussed. Experimental results as to permeability and losses for various materials, thicknesses and frequencies are given, the last-named up to 200,000 cycles per second from data published by Alexanderson.—*Electric Journal*, October, 1925.

Motors and Control

High-Speed Wind Motors—K. BILAU. The vast advances made during the last ten years in aërodynamics have brought about a radical change in the designs of wind motors or windmills. It has now been definitely established that a two-wing or a four-wing propeller wheel gives a much more favorable performance than the formerly much-used multi-vane wheels. In addition, such airplane-type propellers give a much higher speed, which is of particular advantage in driving dynamos. Latest types of propeller wheels have a circumferential speed of up to twice the driving wind velocity. Extensive and costly tests made partly in England and partly in Germany have shown that an attempt to protect such wheels against too high winds by turning the wheel out of the wind have never been successful. Much more promising is a very strong con-

struction of the vanes, built similarly to airplane wings, and small ailerons, mounted on the main vanes, which act as very powerful eddy brakes in case of high winds. For example, a four-vane wheel 55 ft. in diameter, built along these principles, has withstood safely 65 r.p.m. Considering a 10-kw. type, mounted on a reinforced concrete pole with dynamo and drive built into the hub of the four-vane propeller, the author gives detailed cost figures.—*Elektrotechnische Zeitschrift*, Sept, 10, 1925.

Mechanical Starter. — M. PREEL.—Certain machines—in particular, centrifuges — presents a difficult starting condition when direct drive by an electric motor is required. Especially on squirrel-cage induction motors, dangerous rotor currents may result during a prolonged and heavy starting period. For such conditions the author has developed an ingenious mechanical starter which not only relieves the motor of all starting troubles but insures at the same time an exactly predetermined starting period. Between the motor and the centrifuge is interposed a planetary gear set, which permits the motor to make an idle start. The outer cylinder of the planetary gear operates, however, over a worm drive and two brake shoes, and as the motor keeps on running these brakes are gradually applied to the cylinder, so that less and less energy will be transmitted to the cylinder and more and more to the centrifuge. When the brakes have fully arrested the cylinder the motor drives the centrifuge directly. —*Revue Générale de l'Electricité*, Sept. 12, 1925.

Electrophysics, Electrochemistry, and Batteries

Chemical Reduction of the Diameter of Tungsten Wires. — W. SAMTER. — Miniature lamps, such as are used for flash lights, medical instruments, etc., require up to 200 milliamp. current, which gives for dry-cell operation only about three-quarters of an hour of useful light for a pocket-size flashlamp. A reduction of current consumption to 40 milliamp. or 20 milliamp. would increase the life of such flashlights to twenty hours. But the necessary reduction of the thickness of the tungsten wire cannot be accomplished by the customary drawing process. The author has investigated a chemical reduction, by etching, and found that melted potassium nitrate at a temperature of 340 deg. C. produces a very uniform etching of tungsten wires. It was thus possible to reduce wires of 0.014 mm. diameter to about 0.007 mm. diameter within forty-five seconds. Lamps with filaments of such wires consume only 20 milliamp. to 30 milliamp. and show a useful life average of fifty hours.—*Zeitschrift fur Technische Physik*, No. 7a, 1925.

Making Sodium Nitrite by the Arc Process.—H. K. BENSON. — The plant here described is that of the Pacific Nitrogen Products Company at Seattle, originally designed for an output of 3 tons per day and subsequently enlarged. A high-voltage arc (voltage is not stated) plays between water-cooled electrodes, made of iron pipe, in the inner chamber of three concrete tubes, the two annular spaces being traversed in series by the entering air. The gases, with a final nitric-oxide content approaching 2 per cent, are then forced through an absorption tower, where they come into contact with a solution of soda ash descending in a thin film over webbed tile fillers. The outflowing liquor is concentrated in an evaporator and then discharged into crystallizing tanks where the deposition of nearly pure sodium nitrite takes place. The principal as well as the unavoidable secondary reactions are given. — *Chemical and Metallurgical Engineering*, October, 1925.

Non-Magnetic Films of Nickel.—L. R. INGERSOLL and S. S. DE VINNEY.—Films prepared by sputtering nickel in hydrogen on to a cooled surface with a 1,000-volt direct-current generator are initially non-magnetic, showing neither magneto-optic rotation nor tractive effects in a magnetic field. After heating to 300 deg. or 400 deg. C., however, they become strongly magnetic. The gain in magnetic properties is accompanied by a decrease in electric resistance to a fraction of its initial value. From these and other observations the conclusion is drawn that ferromagnetism in nickel requires a crystalline structure and is therefore not a property of the individual atom but of the crystalline aggregate.—*Physical Review*, July, 1925.

Preparation of Fused Iron Oxide for Use as a Catalyst.—A. T. LARSON and C. N. RICHARDSON.—The manufacture of iron catalysts for the direct synthesis of ammonia usually involves the preparation of an iron oxide admixed with certain other metallic oxides which act as "promoters." The method of fusing iron oxide described in this paper consists essentially in melting the oxide together with the desired promoter ingredients upon a protecting bed having virtually the same composition as the catalyst material. The operation is carried on in a three-phase electric furnace with water-cooled electrodes. Current is taken at various voltages from 110 volts down, apparently by changing the connections of the transformer coils so that larger curents can be had at the lower voltages. The full voltage is first applied, after a fused path has been made with the aid of an auxiliary electrode. As fusion proceeds the voltage is reduced and the current rises. Melts of 400 lb. have been obtained with a 180-kva. installation. For a 100-lb. batch the time required is about one hour. The energy consumption varied from 0.5 kw.-hr. to 0.75 kw.-hr. per pound.—*Industrial and Engineering Chemistry*, September, 1925.

Traction

Main-Line Railway Electrification.—No. IX, France.—SIR PHILIP DAWSON and S. PARKER SMITH.—Like the preceding parts of this comprehensive survey of electrification in Europe, the present section gives for the country under consideration a historical review of the conditions that have led to the decision to electrify, a description of lines now in operation or in process of conversion to electrical operation, plans for the future, a study of power sources and data on locomotives, power stations, line construction and substations. In general, operation is to be standardized at 1,500 volts, direct current, with either third-rail or overhead contacts, the power being taken from the uniform national 150-kv., three-phase, 50-cycle network in common with other loads.—*Engineer (England)*, Oct. 2, 1925.

Telegraphy, Telephony, Radio and Signals

Modern Telephone Repeater Stations.—A. B. HART.—The principal members of the network of modern high-efficiency telephone cables connecting the important towns of Great Britain have now been completed. Repeater stations are located at average intervals of 50 miles along the cable routes. The present article shows a plan of the routes, from Penzance and Dover in the south to Aberdeen in the north, and gives an illustrated description of one of the new repeater stations. Signaling system, wiring, testing and batteries are discussed. For the power plant various possibilities were considered; the prime mover adopted is a horizontal four-stroke-cycle oil engine of 76 b.-hp., driving a 22-volt to 30-volt, 1,000 - amp. generator. — *Electrician (England)*, Sept. 11 and 18, 1925.

Suppression of Interference Between Railway Feeders and Telephone Lines.—W. SCHULER.—An extended literature has accumulated during the last ten years dealing with the various suggested and employed means to reduce interference from alternating-current railways with telephone systems. The author discusses in this article protective methods that have been used successfully by four European countries. For every case an absolutely satisfactory solution can be found, it is maintained, provided no ground return is utilized for the telephone lines. — *Elektrotechnische Zeitschrift*, Sept, 3, 1925.

Effect of Wave Damping in Radio Direction Finding. — R. L. SMITH-ROSE.—Earlier investigators have inclined to the belief that deviations in the apparent direction of a source of waves, as determined by a direction finder, have been more serious with undamped than with damped waves. Since the comparisons could not be made on the same wave lengths, it has, however, been a question whether the observed difference in the distortion was due to difference in wave length or in damping. On the basis of recent systematic observations on several stations, each of which sent both kinds of waves, on the same or approximately the same wave length for a given station, the writer concludes that the liability of direction finders to the type of error known as the "night effect" is equally great with damped and with undamped waves. The extreme variations observed at night greatly exceeded those by day, running in the former case above 50 deg. in a number of instances, while rarely amounting to 10 deg. in the latter. Data on which these conclusions are founded are tabulated. The wave-lengths employed ranged from 750 m. to 6,000 m. —*Journal of I. E. E. (England)*, September, 1925.

News of the Industry

California-Oregon Acquired

Byllesby Interests Add Large Interstate Company to Their Pacific Coast Holdings

CONTROL of the California-Oregon Power Company has passed into the hands of H. M. Byllesby & Company, according to official announcement made in San Francisco on Wednesday of this week. J. D. Grant and John D. McKee, acting for themselves and other stockholders of the California-Oregon Power Company, have effected an arrangement with the Byllesby company for the consolidation of the California-Oregon Power Company with a new company to be organized and controlled by the Byllesby interests. The basis for the consolidation is an exchange of stock of the California-Oregon Power Company for securities of the new company. The new securities in definitive form will be issued and delivered through the Mercantile Trust Company of San Francisco.

The central-station system of the California-Oregon Power Company in southern Oregon and northern California is strategically located between a group of interconnected companies to the north in Oregon and Washington and another large group to the south in California. With the electric utility properties already under control of the Byllesby company on the Pacific Coast, the new acquisition gives this company the nucleus of a vast interconnected system. The California-Oregon company already connects with the Byllesby-owned Mountain States Power Company in Oregon through a 130-mile, 110-kv. transmission line, and with an extension of the California-Oregon 110-kv. line, which now extends about 9 miles down into California, to the proposed 90,000-hp. Bean Creek plant on the Middle Fork of the Feather River the Byllesby interests will have a 110-kv. bus extending from Springfield, Ore., on the north to Stockton, Cal., on the south, a distance of about 500 miles.

In addition to the Mountain States Power Company and the California-Oregon Power Company, the Byllesby company now owns or controls the Western States Gas & Electric Company of Stockton, Richmond and Eureka, Cal.; the Coast Valleys Gas & Electric Company of Salinas, Cal., and the San Diego (Cal.) Consolidated Gas & Electric Company. The Sierra & San Francisco Power Company (under lease to the Pacific Gas & Electric) is also controlled by the Byllesby interests.

Byllesby & Company to Buy St. Paul Gas Light

Subject to the approval of the state authorities, the Northern States Power Company has completed arrangements for the acquisition of the St. Paul Gas Light Company, which supplies 70 per cent of the electric light and power used in the city of St. Paul, as well as all the gas service. This announcement was made this week by H. M. Byllesby & Company. The St. Paul Gas Company has heretofore been controlled by the American Light & Traction Company of New York.

R. E. Pack, vice-president of the Northern States Power Company, commenting on the proposed consolidation, said that the unified operations of the electric utilities in St. Paul will insure better service and improved operating efficiency as well as use to greater advantage the large hydro-electric and steam power stations of the Northern States Power Company.

Disagreement Over Muscle Shoals Impends

But President Still Hopes His Commission Will Unite in Report That He Can Submit to Congress—Division of Three to Two Indicated

SUBMISSION of the findings of the Muscle Shoals Commission to the President is likely to be delayed beyond November 15, the date originally fixed for the completion of the report. The President has been informed of the difficulties which have arisen in the commission. He has indicated, however, that he has not given up hope that the differences of opinion among the members may be ironed out to the extent that they may agree on some recommendation for the disposition of the government's properties at Muscle Shoals.

Chairman McKenzie of the commission was a White House caller on November 2. His visit gave rise to the publication of statements that he had submitted a majority report, but at the offices of the commission this was denied. Only a progress report was made to the President by Mr. McKenzie, it is said. Commissioners Curtis and McClellan are known to be working on a report which it may be necessary for them to submit as embodying minority views.

Chairman McKenzie and Commissioners Dial and Bower are understood to favor large-scale manufacture of fertilizer at Muscle Shoals. While they state that they prefer that private enterprise undertake this operation, they are at the same time insisting upon guarantees as to output which take the project out of the realm of economic undertakings. Commissioners Curtis and McClellan are said to stand for the separation of the fertilizer and power phases of the project. None the less, it is believed that they would agree to the allocation of a relatively small amount of power which could be devoted to the experimental manufacture of fertilizer on a large enough scale to be semi-commercial in character.

It is believed that an intensive effort will be made prior to the opening of Congress to bring out of the Muscle Shoals Commission a report which the President will be willing to pass on to Congress with his approval. In fact, the President is said to have expressed this wish. It is known to be his hope that this report will present facts, as distinguished from opinion and deduction, which will enable Congress to make a speedy disposition of the matter. It also is known, however, that the President has not changed the position which he has taken in his previous communications to Congress on the subject.

The President is represented as having said that he regards the fertilizer phase of the question as a very important one. Some were of the opinion that he might have accepted the views of military authorities who are convinced that developments in the art of producing nitrogen have been such as to render Muscle Shoals of little value in this connection. It is said to be the opinion of some of those who have studied the project from the military viewpoint that were war to break out today and the country be cut off from supplies of nitrate of soda from Chile, all of the nitrogen needed could be obtained to greater advantage at points other than Muscle Shoals and that reliance would not be placed on the plants there for any portion of the nitrogen supply for explosives.

NEW BID SUBMITTED

Fred C. Hepburn, former vice-president of the Penn Public Service Company, and a group of New York men have submitted a bid for the operation of Muscle Shoals under a fifty-year lease. They guarantee to produce all fertilizer that the market will consume, with or without profit, at an annual rental of $2,000,000. The bidders propose to form a fifteen-million-dollar corporation to take over all of the government's holding at Muscle Shoals. In addition to manufacturing fertilizer they would produce other chemicals.

Valuation of San Francisco Distribution Systems

Valuation of the Great Western Power Company's distribution system within the city limits of San Francisco has been set tentatively at $10,439,990 by engineers of the California Railroad Commission in a hearing before that body in the condemnation proceedings brought by the city of San Francisco against the two local power companies

in connection with the desired acquisition of a system for distributing Hetch Hetchy power. The figure named by the commission is a temporary valuation and includes, in addition to physical assets, the value of the properties of the Universal Electric Company, a small company jointly owned by the Great Western Power Company and the Pacific Gas & Electric Company. Such items as severance damages, good will, additions and improvements made since February 11, 1924, were not included. As the final figures will not be ready until December 4, the hearing was continued until that date.

Tangible assets of the Pacific Gas & Electric Company have been appraised at $24,914,510 as of February 11, 1924, by engineers of the commission. The commission's figures do not include severance damages, good will nor additions and betterments made since February 11, 1924. Besides these items the value of the Pacific Gas & Electric Company's interest in the Universal Electric Company must be included.

Attorneys for the company placed the valuation of the Pacific Gas & Electric distribution system in San Francisco at $55,000,000. This hearing was continued until January 12 to allow both sides to examine into the figures.

Commission May Have Exceeded Power

Power Board's Action on Colorado River Questioned—Mohave Canyon Site Applied For—White River Site Is Still in Controversy

THE action of the Federal Power Commission in suspending consideration of all applications on the Colorado River and its tributaries applies, it is pointed out, just as effectively to the Boulder Canyon project as it does to that of J. B. Girand at Diamond Creek. The commission is fully aware that if there should be any danger to the upper states it would come from a project involving large storage like that proposed at Boulder Canyon and not from one with an insignificant amount of storage such as is involved at Diamond Creek. The Girand dam simply is for the creation of head and not storage. The question also has been raised as to whether the commission did not exceed its authority in suspending the operation of an act of Congress, particularly when the purpose involved was distribution of water among states—a matter over which the commission has no authority.

The Southern California Edison Company has applied to the commission for a preliminary permit covering the Mohave Canyon site on the Colorado River. It is proposed to construct a concrete dam 168 ft. high at a point in the canyon 2½ miles below Topock. The application is in conflict with several other applications previously filed.

CONTEST FOR WHITE RIVER

In addition to the application of the White River Power Company, noted recently, for development rights on the White River in Arkansas left unappropriated by the expiration of the permit of the Dixie Power Company, another application for substantially the same rights has been filed by the Ozarks Hydro-Electric Power Company. The Ozarks company wishes to construct one dam in the White River, one in the North Fork of the White River and a third in Buffalo River. The company expects in that way to develop 208,677 hp., as against the estimated 250,000 hp. of the White River company. Its project is more extensive than that covered by the preliminary permit held by the Dixie Power Company, all the outstanding stock of which it is said to have purchased. The incorporators of the Ozarks company are Charles S. McCain and other business men of Little Rock and Pine Bluff who were identified with the Dixie company.

The White River Power Company is said to have been organized by North American Company interests which intend to use the power in St. Louis. Litigation in the Arkansas courts and a contest before the Arkansas Railroad Commission are in process. Thus the fight over White River continues to be waged.

Delaware Corporation Purchase Approved in New York

Approval of a purchase of New York companies operating light and power plants by a holding company incorporated in another state was granted by the Public Service Commission of New York last week, when it gave its sanction to the acquisition by the Power & Electric Securities Corporation of Wilmington, Del., of the majority of the common capital stock of the Malone Light & Power Company and all of the common capital stock of the Fort Covington Light, Heat & Power Company and the Milling & Lighting Company of Brasher Falls, all in the northern part of New York State. The Power & Electric Securities Corporation is owned by the same interests that control the Northern New York Utilities, Inc., of Watertown. The lines of this system, already linked with the Niagara, Lockport & Ontario Power Company and the Utica Gas & Electric Company, will be linked with the lines of the Malone, Fort Covington and Brasher Falls companies. Large undeveloped powers owned by these companies will, it is said, be developed and brought into the system.

The commission calls attention to the fact that the Power & Electric Securities Corporation was created before any question arose as to permitting foreign corporations to hold the stock of domestic utilities. Last May the commission refused its consent to the sale to the Consumers' Electric Service Corporation, organized under the laws of Delaware, of the capital stock of two New York operating companies (see ELECTRICAL WORLD for May 9, page 989). A certain change of view on the part of the commission would therefore seem to have taken place.

Orders were also issued by the commission setting forth the portions of the town of Constable in which the Malone Light & Power Company and the Chasm Power Company of Chateaugay may respectively distribute electricity. The Town Board granted general franchises to both companies, and the matter has been waiting adjustment.

Program for A. E. C.

Engineering Council to Analyze "Giant Power" Report—It May Also Study Public Utilities

THE administrative board of the American Engineering Council, meeting at Columbus, Ohio, October 29 and 30, authorized the appointment of a committee to review and analyze the "Giant Power" report issued by Governor Pinchot of Pennsylvania. The reviewing committee is to be chosen by the executive committee of the council, to which it is to report at the earliest practicable moment. The board's action, taken unanimously, followed representations that the "Giant Power" report contains economic fallacies likely to mislead the public. The aim of the analysis is to provide a popular interpretation of the report from an engineering standpoint.

Plans contemplating a nation-wide study of public utilities were set in motion by the board, which voted to appoint a committee to determine a definite scheme of investigation and report to the council at its annual meeting in Washington early in January. The committee consists of Dean Dexter S. Kimball of Cornell University and Fred J. Miller, both past-presidents of the American Society of Mechanical Engineers; A. W. Berresford of Niagara Falls, N. Y., American Institute of Electrical Engineers, and Lawrence W. Wallace of Washington, executive secretary of the American Engineering Council. Questions confronting the engineers, should the council decide to undertake the study, involve where federal regulation should end and state or municipal regulation begin; what should be the policy with reference to regulation of superpower systems; whether methods of regulation should be written into state constitutions; theories of valuation, theories of rate making, and the standards of service required by federal and state commissions. The cost of the survey was estimated at from $25,000 to $35,000.

The board voted to press effort in the field of federal government reorganization and authorized the presentation at the next session of Congress of a bill establishing a Division of Public Works in the Department of the Interior. The board also adopted a resolution to introduce in Congress a bill providing for an inventory of the water resources of the United States. This inventory would be intrusted to the Geological Survey and would be completed within twenty years. Evidence to show a widespread demand among engineering organizations for this work was presented by the executive secretary.

N. E. L. A. Executive Plans

Chicago Meeting Indicates Optimistic Outlook for the Year Now Entered Upon

MEETING in Chicago on October 26, with only two members absent, the national executive committee of the National Electric Light Association adopted budgets for the new year. The meeting was addressed by E. M. Herr, president of the Westinghouse Electric & Manufacturing Company; Gerard Swope, president of the General Electric Company, and W. A. Layman, president of the Wagner Electric Corporation, as well as by Clyde Chamblin of California for the contractor-dealers and W. E. Robertson of Buffalo for the jobbers. Geographic division presidents all reported prospects for 1926 good, without any indication of spectacular achievement.

The new national section chairmen—M. S. Sloan, C. M. Breitinger, E. W. Lloyd and C. F. Hirshfeld—spoke respectively for the Public Relations, Accounting, Commercial and Technical Section, outlining plans and reporting progress. Miss Isabel Davie was indorsed as permanent secretary for women's work at national headquarters. Miss Elizabeth Lee, chairman of the national women's committee, outlined the educational program and the "personal contact" program of that committee and said that the committee had appointed a representative to look after the ramifications of women's work in electrical manufacturing companies.

Charles Penrose of Day & Zimmermann, Philadelphia, blamed upon the industry's failure to "sell itself" to the public the tri-state committee appointed by the Governors of New York, New Jersey and Pennsylvania to investigate interstate interconnection. He accused the governors of ignorance of the facts and factors involved.

A. Emory Wishon, chairman customer ownership committee, reported wide-reaching plans to convince the entire industry of the benefits of such ownership. J. C. McQuiston, chairman manufacturers' advertising committee, said twice as much co-operation as in last year had been received from the manufacturers. John C. Parker, chairman of the committee on co-operation with educational institutions, announced that the long-awaited textbook upon public utilities will be out not later than May 1 next. M. S. Sloan, chairman of the committee on relations with financial institutions, reported that the bankers' associations of New York are behind a bill to legalize investment in public utility securities in that state by banks, trust companies and trustees.

Yonah Plant Goes on Georgia Railway & Power Lines

The first unit of the Yonah hydro-electric plant, fourth in a series of six power developments planned for the Tallulah, Chattooga and Tugalo River system of the Georgia Railway & Power Company, went into service last week with a generating capacity of 12,500 hp.

This plant, work on which has been proceeding for nearly two years, is on the Georgia side of the Tugalo River about 3 miles below the existing Tugalo plant. The masonry dam is 70 ft. high and 900 ft. long. The power house, when completed, will contain three units with a combined capacity of 25,000 kw. The other two units will, it is thought, be ready by January 1.

The chain of plants of which Yonah is one use the same water over and over as it proceeds down the Tallulah and Chattooga Rivers. Two more developments will be started as soon as the Yonah plant is completed. They are the Nacoochee project, which will be at the head of Lake Rabun, and the Burton project, which will be at the foot of Lake Burton. The two will add 16,500 hp. to that already developed and will bring the total power of the system up to 279,500 hp. The new plant will supply energy to Atlanta and other cities, whither it will be transmitted at 110,000 volts.

Geysers Offer Power Possibilities

Investigation of Eruptive Hot Springs in Sonoma County, Cal., Shows Potential Output of 50,000 Kw.— Commercial Development Planned

WHILE the attention of engineers and scientists in some parts of the world has been turned toward the utilization of tidal power, a group of California engineers and capitalists, as previously reported, has been investigating the power possibilities of the geysers in Sonoma County in that state. The geyser region under investigation lies about 30 miles north of Santa Rosa, Cal., and about 75 miles north of San Francisco. Test wells already sunk indicate a quantity of steam available in that area at a pressure sufficient to develop about 50,000 kw.

SATURATED STEAM DISCHARGING FROM WELL NO. 7

Pressures range from 62 lb. on the older wells to a maximum of 276 lb. on some of the more recent wells when capped.

These test wells, which are seven in number, are iron-cased and range in diameter from 8 in. to 12 in. and in depth from 260 ft. to 550 ft., with an average depth of 460 ft. for the later wells. There is an overburden of from 50 ft. to 100 ft. composed of earth and rock, and below this lies a stratum of sandstone with pockets or "fumeroles," as the Italians call them, containing steam. The pressure of two of the older wells is 62 lb. closed, while the pressure on some of the later wells has reached a maximum of 276 lb. when capped. Temperature tests indicate saturated steam with temperature corresponding to the pressure and reaching a maximum of 600 deg. F. In some of the older wells there is an indication of about 10 deg. of superheat.

The area under investigation is approximately 1,500 ft. x 2,000 ft., of irregular shape, and lies in a canyon with a creek at the bottom. Those interested in the project own a total of about 2,400 acres extending some four miles up and down the canyon, where there is some indication of activity. Investigation in the present area is being conducted to determine the extent of the territory and the yield of the wells. The wells have been allowed to blow off at a given pressure for a period of thirty days and then tested to obtain data as to pressure and volume. These tests support the opinion of geologists that the steam supply is permanent.

The average steam supply from four wells drilled indicates about 25,000 lb. of steam per hour per well at a gage pressure of 100 lb. All recent drilling operations have been carried on with steam engines driven by steam from previous wells. A 25-hp. turbo-generator set has been in operation for some time and experiments are being made with various metals in the turbine runner blades to determine the corrosive action of the gases. Analysis shows that the steam contains less than 1 per cent of non-condensible gases and a very small percentage of sulphur, and no difficulty is anticipated in finding a metal that will withstand the action of the gases.

Engineers in charge of the investigation feel that in the area under investigation there is a potential steam power of 50,000 kw. Preliminary plans for commercial development have been made for a 10,000-kw. and a 15,000-kw. low-pressure turbo-generator installation to operate either condensing or non-condensing. If it is found that the turbines can be operated condensing, it will be possible to get along with about one-half the number of wells otherwise required. The plan of development would be to pipe the steam from the wells to a common header and thence to the power plant and the turbines. No boilers, of course, would be

required, but the expense of drilling the wells would make the first cost of the installation about the same as for an ordinary boiler plant. Operating costs, however, would be much less because of the absence of fuel cost. The power developed would probably be transmitted to the existing power systems and sold at wholesale.

There are a number of places in northern California where there is evidence of heat close to the earth's surface, and if the scheme now under consideration is successfully carried out, attention will no doubt be directed to the power possibilities of other regions.

State Permit Granted for Chelan River Project

A permit for the construction of a power station and dam on the Chelan River between the town of Chelan, Wash., and the Columbia River was granted to the Chelan Electric Company by R. E. Tiffany, Supervisor of Hydraulics of the State of Washington, on October 24. Permission was secured from the state government after a public hearing at Chelan earlier in the week, which indicated an overwhelming sentiment for the development, fears of injuring the beauty of the lake being allayed. Throughout the hearing the figure of 100,000 developed horsepower was used, with costs estimated at from $7,500,000 to $10,000,000. The Chelan Electric Company is to be taken over by the Washington Water Power Company. It is at present controlled by the Great Northern Railway, which plans to use Chelan River power in the electrification of its main line, and it has yet to obtain a permit from the Federal Power Commission, as a part of the overflow land is on forest reserve territory.

A. S. T. M. Committees Meet in Cleveland

A series of meetings was held in Cleveland by a number of the committees of the American Society for Testing Materials on October 27, 28 and 29. The committee on electrical insulating materials, of which F. M. Farmer, chief engineer Electrical Testing Laboratories, New York, is chairman, received reports from sub-committees on insulating varnishes, molded insulating materials, porcelain, sheet insulation, liquid insulation, cable splicing and pothead compounds, and radio frequency tests. All these committees reported experimental progress.

A new committee on metallic materials for electric heating was set up, with Dean Harvey of the Westinghouse company as chairman, and five subcommittees will deal respectively with life tests, physical and electrical tests, chemical analysis, standard sizes and packages, and application of data. It will be the first time that a fundamental study of this field has been made by producers and consumers of such material working together. Other committees which met were those on coal and coke, corrosion of iron and steel, rubber products, and the effect of temperature on the properties of the metals.

Praises Holding Companies

J. H. Pardee Maintains that Management by Them Is a Benefit to Central Stations

IMPROVED local service and greater stability for securities are two inevitable results of holding-company management of utility properties, J. H. Pardee, president of the J. G. White Management Corporation, told the Academy of Political Science at its meeting last week. He emphatically insisted that holding companies do not sell inflated securities, first, because it is not good business, and, second, because their securities are based on the securities of operating companies, which have in most cases the approval of public service commissions. The charge that holding companies have no local interest in properties managed is without foundation, he declared, because local success is essential to group prosperity.

During the last twelve years, in which holding-company management has had its greatest impetus, especially among electric light properties, the average cost of electricity has decreased 10 per cent, Mr. Pardee declared. This reduction, in the face of a 60 per cent increase in bituminous and a 95 per cent increase in anthracite coal costs, has proved, he maintained, that holding-company managements do not increase rates to the consumer. The fact that virtually every community of 5,000 population and more than 14,000 with less than 2,500 population now have electric service was attributed by Mr. Pardee to holding-company operation.

"Single entities, functioning separately, could not have performed this feat," he said. "Only the community of interest that has arisen as a result of the concentration of responsibility and control has made it possible. Transmission lines extending distances unheard of five years ago now link important sources of energy with large distribution centers and in passing from one point to another bring to thousands a service which could not be brought to them otherwise. An individual utility could not under any except the most extraordinary circumstances search out and develop a power source as much as one hundred miles away. The difficulties in the way of a single utility doing it are almost insuperable. The holding company cannot be successful unless its subsidiaries are," he continued. "Its subsidiaries can be successful only as long as their business rests upon the firm foundation of public confidence, which in turn can be built only upon good service."

"In the public utility field the holding company is a legal device for the control of operating public utility companies," said Philip P. Wells, Deputy Attorney General of Pennsylvania, speaking at the same meeting. "The controlling holding company, not the controlled operating company, embodies the will and the thought of the men who have the power to direct these public services from the point of view of private profit and who therefore ought to be responsible for that direction to the regulatory public authority. This responsibility generally does not exist," said Mr. Wells. "Irresponsible power is always dangerous." Mr. Wells also said that the holding company, in some of its developments, menaces proper responsibility of managers to investors.

Census to Include Questions on Industrial Heating

The United States Census Bureau has decided to include in its 1926 Census of Manufactures the following questions on the use of electrical energy in industry:

Privately generated energy consumed for power purposes?
Privately generated energy consumed for industrial heating purposes?
Privately generated energy consumed in electrolytic and in electrochemical processes?
Central-station energy consumed for power purposes?
Central-station energy consumed for industrial heating purposes?
Central-station energy consumed in electrolytic and in electrochemical processes?
Average central-station power load for the year in kilowatts?
Average central-station industrial heating load for the year in kilowatts?
Average central-station electrolytic and electrochemical load for the year in kilowatts?

Judges Appointed for the J. H. McGraw Awards

Judges have been appointed to award the medal and purse to be given under the James H. McGraw award in recognition of the most constructive contribution made during the year 1924 for the advancement of the manufacturing branch of the electrical industry. The committee is as follows: Clarence L. Collens, 2d, president Reliance Electric & Engineering Company; Gerard Swope, president General Electric Company; A. E. Waller, president Ward Leonard Company; W. H. Thornley, president Tubular Woven Fabric Company, serving as presidents of the Electrical Manufacturers' Council, Electrical Manufacturers' Club, Electric Power Club and Associated Manufacturers of Electrical Supplies, respectively.

A similar committee of judges has been appointed by the Electrical Supply Jobbers' Association to award the medal and purse to be given in recognition of the most constructive contribution made during the year 1924 to the jobbing branch of the electrical industry. This committee includes John L. Owen, E. B. Latham & Company; C. McKew Parr, president Parr Electric Company; C. P. Lashelle, president W. R. Ostrander & Company, and A. F. Thatcher, Alpha Electric Company.

Tenney Interests Will Sell Bristol (Conn.) Company

The Bristol & Plainville (Conn.) Electric Company will shortly be acquired by the Connecticut Light & Power Company of Waterbury, if two-thirds of the former's stockholders accept an offer of $287.50 per share as recommended by the directors at a meeting this week in Hartford. The Bristol company has been under the management of Charles H. Tenney & Company, Boston, since 1914. It serves a populous and diversified manufacturing district between New Britain and Waterbury.

Power in New Brunswick

Present Status of Grand Falls Hydro-Electric Project—Market Limitations Throw Doubt on Its Value

ALTHOUGH the provincial government of New Brunswick, which had awarded the general contract for the Grand Falls hydro-electric development on the St. John River to the Dominion Construction Company of Montreal, was defeated at the elections on August 10 and the succeeding Conservative government suspended the beginning of the work until a complete investigation of the possible market for power could be made, it is understood, Trade Commissioner Lynn W. Meekins reports from Ottawa, that, in view of the expenditure by the commission of $114,368 upon the preliminary investigation of the development and because of the limited quantity of power available at the Musquash plant, the new government will proceed with the undertaking.

The engineers' estimate of the cost of the Grand Falls development for an initial installed capacity of 50,000 hp. is $7,900,000, or $158 per horsepower. It will be reduced to $133 when the capacity is increased to 75,000 hp. Advocates of the project maintain that the final cost of $133 compares favorably with the present cost of power development at Niagara Falls, which is said to be $140. The former government retained the services of Dr. Henry G. Acres, consulting engineer of the Ontario Hydro-Electric Power Commission, and aimed to duplicate on a smaller scale in New Brunswick the remarkable development which has taken place in Ontario. A comparison of the area and the population of the two provinces, together with a parallel examination of their natural resources, shows, however, that, regardless of whatever the final hydro-electric development in New Brunswick may be, its limitations are clearly defined. Manufacturing in New Brunswick seems incapable of very extensive development because of the location of the province with respect to the Canadian market and the lack of native raw materials other than timber and pulpwood. Only four cities have a population of more than five thousand.

Since the organization of the New Brunswick Electric Power Commission the average net cost per kilowatt-hour to consumers in the city of St. John has been reduced from 13.5 cents for domestic lighting to 5.7 cents and from 13.5 cents for commercial lighting to 4.6 cents. The commission now serves more than one-half of the power consumers of New Brunswick. Its power plant on the Musquash River near St. John produced 11,275,000 kw.-hr. during the year ended October 31, 1924. The net operating deficit of this plant during the period indicated was $71,822. The capital cost of the Musquash development, transmission lines and rural distribution systems up to October 31, 1924, was $3,303,960.

In some quarters the international and interprovincial aspects of the Grand Falls project have created doubt. Of the St. John River drainage area above Grand Falls, consisting of 8,700 square miles, 4,420 square miles is in Maine, 2,830 square miles in Quebec and only 1,450 square miles in New Brunswick. For this reason it is advocated that attention be given to smaller projects within the provincial boundaries which would cost less to develop and which would not involve any external rights.

Government Report on Hydro in Maritime Provinces

During the last few years available water power to the extent of 550,000 hp. has been investigated in Nova Scotia and New Brunswick, according to a Dominion government report. The Nova Scotia Power Commission was created in 1919 and the New Brunswick Electric Power Commission the following year. Since then modern hydro-electric developments with a total installed capacity of 34,000 hp. have been developed by these bodies, all of which is in actual use.

Besides the Grand Falls project in New Brunswick, plans are active in Nova Scotia also, where extensions to the St. Margaret's Bay and Sheet Harbor systems are projected and studies are being made for developments on the St. Croix River, Bear River, Liscomb River and Mersey River. Developments on the last named river taken as a whole are said to constitute a concentrated source of power comparable with that at Grand Falls. The total water-power development in the three maritime provinces up to February, 1925, is estimated by the Dominion Water Power and Reclamation Service at 110,900 hp., of which 44,650 hp. was in New Brunswick, 64,000 hp. in Nova Scotia and 2,275 hp. in Prince Edward Island.

Addressing a meeting at St. John, N. B., recently, Premier J. B. M. Baxter said that the development at Grand Falls would be carried out regardless of politics, with no direct or indirect taxation to the people or the loss of one dollar.

E. A. Reilly, a Moncton lawyer, has been appointed chairman of the New Brunwick Hydro-Electric Commission. All of the members of the old commission resigned, and their places will be taken by Mr. Reilly, J. D. Palmer of Fredericton, E. K. Shofield of St. John, A. D. Ganong of St. Stephen and F. J. Robidoux of Shediac.

Tri-State Power Commission Holds First Session

At an organization meeting of the newly appointed Joint Power Commission of New York, Pennsylvania and New Jersey, held at Princeton, N. J., last Saturday, Dr. Charles Browne of Princeton, a member of the Board of Public Utility Commissioners of New Jersey, was chosen chairman; William A. Prendergast, chairman of the Public Service Commission of New York State, was chosen vice-chairman, and Philip P. Wells, Assistant Attorney General of Pennsylvania and chairman of the Pennsylvania Power Board, was made secretary.

It was decided to ask the Governors of Delaware, Connecticut, Massachusetts, West Virginia, Maryland and Virginia to appoint representatives to sit with the commission as observers and advisers as to the attitude their states would be likely to take.

The commission plans to study power development, transmission and regulation in New York, New Jersey and Pennsylvania and to recommend legislation so that the states will be able to decide their course of action under the clause of the United States Constitution which gives the individual states the right to enter into compacts as to transportation among themselves, making it unnecessary that the question should come before the Interstate Commerce Commission.

An executive committee was appointed by the chairman, consisting of C. R. Vanneman, chief engineer of the Public Service Commission of New York; Philip P. Wells of Pennsylvania and Robert F. Ingle of Morristown, N. J.

Welding Society Meets

High-Grade Papers, Exhibitions and Demonstrations at Massachusetts Institute of Technology

PERHAPS the most successful convention ever held by the American Welding Society took place last month, October 21-23, at the Massachusetts Institute of Technology, Cambridge, Mass., with more than three hundred members and guests attending the technical meetings and several thousand taking the opportunity to inspect the exhibitions of twenty-five manufacturers of welding machines and equipment. The demonstrations of the exhibitors were of a practical nature, showing how welding equipment is used in the manufacture of commercial products. At the annual banquet held Thursday evening Mayor James M. Curley of Boston, Prof. E. H. Miller and Prof. C. A. Adams of the "Tech" faculty, Prof. Elihu Thomson of the General Electric Company and Prof. A. S. Kinsey of Stevens Institute were the speakers, the speeches and music being broadcast.

In the technical sessions several important papers were presented. "Arc Welding as a Manufacturing Process" was the subject of a paper by H. M. Hobart of the General Electric Company and W. Spraragen, secretary of the American Bureau of Welding. The paper reviewed some of the more prominent applications of arc welding in manufacturing processes connected with locomotive boilers, transformers, motors, pole-piece assembly, commutator shells, motor bases, generator stator frames, oil pans, oil circuit breakers, steel castings, furnaces, etc. The extent of the use of arc welding by the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Lincoln Electric Company and the Western Electric Company was described in detail. It has been the experience of all these companies that arc-welding applications have decreased the cost and improved the quality of product, increased production and overcome manufacturing and other difficulties.

The extensive use of welding in the

assembly of all-steel automobile bodies was described by J. W. Meadowcroft of the Edward G. Budd Manufacturing Company, Philadelphia. This company was the first to adopt arc welding for manufacturing all-steel bodies. Much stress is laid on the design of the parts for these bodies in a minimum number of pieces so as to secure the necessary rigidity and to facilitate their assembly in the jigs and fixtures for welding. Welded joints and seams do not break open, nor do the metals wear upon each other; thus squeaks and other noises are eliminated. The assembled bodies are light in weight, durable, free from defective joints, and present an exterior surface smooth and free enough from imperfections to permit good finishing. On an open-type body the following number of welds are made: 1,000 to 1,100 electric spot welds, 70 in. to 80 in. of acetylene-gas welding and 10 in. to 12 in. of metallic arc welding. On sedan bodies the following are used: 1,600 to 1,700 electric spot welds, 170 in. of acetylene-gas welding and 11 in. to 12 in. of metallic arc welding.

Bright Prospects for the South

Southeastern Division Meeting of N. E. L. A. Enthusiastic Over Developments—Water Shortage Shows Need for Steam Reserves—Well-Balanced Program

SOUNDING the keynote of the convention of the Southeastern Division of the National Electric Light Association, held at Chattanooga, Tenn., on October 29 and 30, Thomas W. Martin in his presidential address declared that the South is coming into its own as a great manufacturing and agricultural area and that electricity has made this possible. Power and light have been made ready for the homes and industries of the Southeast by the electrical industry, he said, and the present rapid developments in the territory can be traced to this fact. He told how all power produced in this region is pooled for the common good and said that this made possible adequate service even in the face of the recent water shortage. Yet only 3.7 per cent of the energy generated is transmitted across state lines. A total of $40,000,000 is being raised this year, Mr. Martin said, to extend the capacity and number of Southern generating plants, and in every way the electrical industry is taking a leading part in the development of the new South. He estimated at $500,000,000 the present value of Southeastern light and power companies, with an annual output of 4,000,000,000 kw.-hr.—an increase of 500,000,000 kw.-hr.

M. H. Aylesworth, managing director N. E. L. A., dwelt on the fortunate national situation in the utility industry, recounting in his effective way the progress made and expressing the conviction that promotion of rural electrification, maintenance of state regulation and wise financing and management are necessary to keep abreast of the standards set in past activities.

The commercial and public relations aspects of the utility business were accented by National President J. E. Davidson in his address. He urged the formation of lighting sales departments and stated that co-operative work in rural electrification projects was bringing a concrete contribution to the solution of this problem. On every hand he saw prosperity in the industry, but he urged still further efforts to give better service, to sell more energy, to obtain more customer-owners and to maintain intelligent management.

The excellent work women are doing in the industry was outlined by Elizabeth Lee, chairman of the national women's committee. Definite programs have been made and applied by this committee and the year has witnessed substantial progress.

At the banquet on Thursday night M. S. Sloan, president Brooklyn Edison Company, spoke ably on public relations. He thought that the industry was in good repute with the public, but said every effort should be made to maintain this condition. Just as most other problems of the industry have been solved, so will the problem of public relations. The utilities need public confidence as do no other industries, and if they will remember to be human, fair and open, the public will give them its support. The goal of the utilities and of the public is the same, Mr. Sloan said, and any unfavorable public relations that may develop are the fault of the utilities. Mr. Sloan urged that as a fundamental step in public relations it is essential for each utility to have a loyal, intelligent group of employees and urged the utilities to employ all legitimate means for publicity and public service in the communities served. At the banquet three Insull medals were awarded by H. W. Moses to utility men for saving lives.

On Friday Major H. C. Fiske told of the survey of the Tennessee basin now under way by government engineers. He said work had progressed far enough to show that existing estimates of power possibilities are conservative. The survey will take two years.

Other addresses at this meeting were made by B. C. Cobb, vice-president Hodenpyl, Hardy & Company, who urged the importance of auxiliary steam plants; Colonel William Kelly of the N. E. L. A., M. O. Leighton of Washington, D. C., and Dr. J. H. Pratt of Biltmore, N. C. Dr. Pratt's topic was "The Economic Aspects of Superpower." The different sections of the geographic division met each day with complete and valuable programs dealing with important topics in the various branches of the industry.

Officers elected for the coming year were: President, R. L. Lindsey, vice-president Durham (N. C.) Public Service Company; first vice-president, B. C. Edgar, vice-president Tennessee Electric Company; second vice-president, J. H. Gill; third vice-president, H. A. Coles.

Maryland and Conowingo

Commission Will Sanction Project if Obstacles of Various Kinds Can Be Surmounted

APPROVAL of the Conowingo power project by the Maryland Public Service Commission hinges upon completion of agreements between the power interests and the State Roads Commission, State Conservation Commission and county authorities protecting state and county property. It also hinges on the report of the Attorney-General of Maryland upon the corporate set-up involving the four companies in the power project, which are the Susquehanna Power Company, the Philadelphia Electric Company, which will market the energy generated at Conowingo; the Susquehanna Electric Company and the Philadelphia Electric Power Company.

Harold E. West, chairman of the Maryland commission, made this announcement at the completion of the final hearing on the Conowingo project, on October 30 before the Maryland commission and representatives of the Pennsylvania Public Service Commission and of the Federal Power Commission. When these details are completed the Maryland commission expects to be ready to approve the project, he declared.

The commissioners heard the testimony of Charles W. Kellogg, engineer of Stone & Webster, the primary contractors, on changes in construction plans. Stevenson A. Williams, counsel for the promoters, explained changes in the corporate structure of the project. William Clarke Mason represented the Philadelphia Electric Company. The Philadelphia Rapid Transit Company, chief opponent of the project, was not represented.

At the conclusion of the presentation of evidence Clarence W. Miles, Maryland People's Counsel, reiterated his conviction that the project could not be regulated under existing laws. J. Wallace Bryan, counsel for the Industrial Power Consumers' Association, supported Mr. Miles' views.

The Maryland commissioners will go to Harrisburg Monday next, November 9, to confer with members of the Pennsylvania Public Service Commission with a view to co-ordinating the orders of the two boards.

Public Hearing on Permits for Tennessee and Tributaries

Notice is given by Major Harold C. Fiske that a public hearing will be held at 815 Broad Street, Chattanooga, Tenn., on December 15 on applications pending before the Federal Power Board for preliminary permits for power and power-navigation dams on the Tennessee, Clinch and Powell Rivers. The following are the applications pending, all the counties mentioned being in the State of Tennessee:

1. The Tennessee Hydro-Electric Company for:

(a) A dam on the Clinch River at a site just below the mouth of the Emory River creating a head of about 70 ft. Proposed installation, 50,000 hp.

(b) A dam on the Clinch River near the bridge of the Louisville & Nashville Rail-

road crossing the Clinch River in Anderson County and creating a head of about 50 ft. Proposed installation, 30,000 hp.

(c) A dam on the Clinch River below the confluence of the Clinch and Powell Rivers and creating a head of about 175 ft. Proposed installation, 130,000 hp.

(d) A dam on the Clinch River above the bridge of the Southern Railway in Grainger County and creating a head of about 260 ft. Proposed installation, 150,000 hp.

(e) A dam on the Powell River about 1 mile above the Southern Railway bridge and creating a head of about 240 ft. Proposed installation, 30,000 hp.

Total proposed installation, 390,000 hp.

2. The Tennessee Electric Power Company for:

(a) A dam on the Clinch River about 5 miles east of Coal Creek in Anderson County, creating a head of about 175 ft. Proposed installation, about 100,000 hp.

(b) A dam on the Clinch River about 4 miles east of the railroad station of Clinch River on the boundary between the Counties of Grainger and Claiborne, creating a head of about 155 ft. Proposed installation, about 50,000 hp.

(c) A dam on the Powell River about 1 mile east of the railroad station at Combs in the County of Claiborne, creating a head of about 170 ft. Proposed installation, about 27,000 hp.

Total proposed installation, about 177,000 hp.

3. The Knoxville Power & Light Company for:

(a) A dam about 4 miles above the bridge of the Southern Railway in Claiborne County, creating a head of about 180 ft. Proposed installation, about 53,000 hp.

(b) A dam on the Clinch River just below the mouth of Coal Creek in Anderson County, creating a head of about 175 ft. Proposed installed capacity, about 95,000 hp.

(c) A dam on the Clinch River just above the mouth of the Emory River, creating a head of about 85 ft. Proposed installation, about 63,000 hp.

(d) A dam on the Clinch River just east of the city of Clinton, creating a head of 35 ft. Proposed installation, about 19,000 hp.

(e) A dam on the Tennessee River at Coulter Shoals about 44 miles below the head of that river, creating a head of about 53 ft. Proposed installed capacity, about 47,600 hp. Provision to be made for locks for navigation.

(f) A dam on the Tennessee River at Marble Bluff about 75 miles below the head of that river, creating a head of about 35 ft. Proposed installation, about 43,900 hp. Provision to be made for locks for navigation.

Total proposed installation, about 321,500 hp.

4. The East Tennessee Development Company for:

(a) A dam (Sherman site) on the Tennessee River in Hamilton County, 4 miles above Walnut Street bridge, Chattanooga, creating a head of about 20 ft. Proposed installed capacity, 44,000 hp. Provision to be made for locks for navigation.

(b) Sale Creek site, on Tennessee River in Hamilton County, 30 miles above Walnut Street bridge, Chattanooga, creating a head of about 25 ft. Proposed installation, about 60,000 hp. Provision to be made for locks for navigation.

(c) White Creek site, on Tennessee River in Rhea and Meigs Counties, 77 miles above Walnut Street bridge, Chattanooga, creating a head of about 38 ft. Proposed installation, 100,000 hp. Provision to be made for locks for navigation.

(d) Marble Bluff site, on Tennessee River in Roane County, 111 miles above Walnut Street bridge, Chattanooga, creating a head of approximately 35 ft. Proposed installation, about 44,000 hp. Provision to be made for locks for navigation.

(e) Coulter Shoals site, on Tennesee River in Loudon and Blount Counties, 142 miles above Walnut Street bridge, Chattanooga, creating a head of about 53 ft. Proposed installation, about 47,000 hp. Provision to be made for locks for navigation.

(f) Senator site, on Clinch River in Roane County, 6 miles above confluence with the Tennessee, creating a head of about 39 ft. Proposed installed capacity, about 36,000 hp. Provision to be made for locks for navigation.

(g) Melton Hill site, on Clinch River in Knox and Anderson Counties, 31 miles above confluence with the Tennessee, creating a head of about 60 ft. Proposed installation, about 54,500 hp. Provision to be made for locks for navigation.

(h) Clinton site, on Clinch River in Anderson County, 68 miles above confluence with the Tennessee, creating a head of about 20 ft. Proposed installation, about 30,500 hp. Provision to be made for locks for navigation.

(i) Clinch No. 3 site, on Clinch River in Anderson County, 4 miles above the county bridge between Coal Creek and Andersonvill, creating a head of about 175 ft. Proposed installation, 100,000 hp.

(j) Clinch No. 2 site, on Clinch River in Grainger and Claiborne Counties, about 42 miles above the dam site of Clinch No. 3 and 4 miles east of railroad station of Clinch River, creating a head of about 160 ft. Proposed installed capacity, about 50,000 hp.

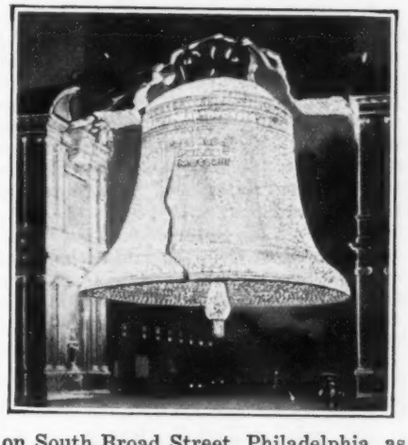
(k) Powell site, on Powell River in Claiborne County, 1 mile east of the railroad station of Combs, creating a head of about 180 ft. Proposed installation, about 26,500 hp.

Total proposed installation, about 592,500 hp.

Briefer News

Great Lakes Meter Conference Postponed.—The meter conference planned by the meter committee of the Great Lakes Division, N. E. L. A., to be held at the factory of the Sangamo Electric Company at Springfield, Ill., in November has been postponed until some time in December.

Illuminating a Liberty Bell Six Stories High.—An illuminated Liberty Bell as high as a six-story building, or about 75 ft., designed by the Westinghouse Lamp Company and containing 20,000 25-watt lamps, is to be erected



on South Broad Street, Philadelphia, as a feature of the Sesqui-Centennial next year. The lights will represent half a million candlepower, and the bell will be visible from either end of the thoroughfare, a distance of more than 4 miles. The bell, which will be 50 ft. in diameter, will be supported by a white Colonial arch, within which will be concealed the 20-ton steel arch necessary to support the weight of the bell, which will have a steel skeleton framework also. Other lighting features planned for the celebration include fourteen 450,000,000-cp. searchlamps to be installed behind the new Museum of Art to produce a curtain of intermingled and vivid colors which will, it is said, be visible for 50 miles in every direction and a "Court of the Thirteen Stars" arranged around the parkway fountain.

Ottawa to Tax Hydro Plant.—By resolution of the Ottawa (Canada) City Council the Ottawa Hydro-Electric Commission is to pay taxes hereafter, on the same basis as the private company with which it competes. It is claimed by the advocates of the tax that there will be no increase in electric light and power rates but that the tax will be paid out of the reserve fund, which is now in the neighborhood of $40,000 a year.

Tennessee Electric Power Seeks Approval of Four New Undertakings.—Approval of the state commission, expected soon, will permit the Tennessee Electric Power Company to conclude four new undertakings. These are the purchase of the Benton Light & Power Company and of the River Electric Light & Power Company, the latter operating in Polk County near Benton, and the exercise of franchises granted by Lewis County and Hickman County.

Des Moines' New Plant Starts Operation.—The first unit of the new Ball's Ford generating plant of the Iowa Power & Light Company, southeast of Des Moines, Iowa, has just been put in operation, with a formal opening and an opportunity to the public to inspect it. This plant and the new plants at Davenport and Sioux City will together increase Iowa's power resources nearly 25 per cent. The Des Moines plant cost $7,000,000 and has an initial rating of 60,000 kva.

Plan to Survey Virginia's Water-Power Resources.—An appropriation of $75,000 as the initial outlay for a survey of the water-power resources of Virginia will be asked of the next General Assembly, according to Wilbur A. Nelson, chief of the department of geology at the University of Virginia. The survey, which has been planned by a commission appointed to study the state's resources, will cost $150,000 and will take four years to complete.

Pit No. 3 Tests Show High Efficiency.—Acceptance tests just completed on the three 33,000-hp. Pelton vertical reaction turbines at the new Pit River No. 3 power house of the Pacific Gas & Electric Company showed a maximum efficiency of 93 per cent. The turbines operate under an effective head of 280 ft. Water measurements were made by the Allen salt-velocity method and the utmost care in all respects was used in conducting the test.

Farmers Oppose Milwaukee Company's Line Extension.—The Milwaukee Electric Railway & Light Company won an appeal before the Circuit Court for a reduction of more than 50 per cent from excessive awards fixed by a condemnation commission for damages resulting to farm property in connection with the construction of a steel-tower transmission line from the Lakeside plant to Plymouth. The jury cut the award of one land owner from $1,260 to $600, and awards to several other land owners in the towns of Wauwatosa and Granville have also been appealed. Total awards to land owners for damages already aggregate $65,000 on this line alone. An example of the difficulty which is being experienced in building this extension occurred on the property

of a farmer in Granville who is dissatisfied over his condemnation award. Twenty workmen who were engaged in putting up equipment over his land are said to have been driven off the property by a band of farmers who armed themselves with axe handles.

Opening of Virginia Electric & Power Company's New Line Celebrated.—Roanoke Rapids, N. C., indulged in an elaborate celebration of the opening of the Virginia Electric & Power Company's new 65-mile, 110,000-volt steel-tower transmission line on October 28. As already reported, this line runs from Roanoke Rapids to Suffolk, Va., where it is interconnected with the company's Richmond-Norfolk line. It cost in the neighborhood of a million dollars and crosses four railroads and four rivers.

Dispute Over Sale of Ohio Plant.—The proposed sale of the property of the Indian Lake (Ohio) Light & Power Company to the Ohio Edison Company of Springfield is being protested before the Public Utilities Commission of the state by J. B. Smith and C. S. Carl of Lima, who declare they have a prior right to purchase the property. Before hearing the case the commission will await an opinion from the Attorney-General as to whether it has the right to hear an action involving alleged breach of contract.

Hawaiian Electric Company Installs New Steam Unit.—A third 12,500-kw. turbo-generator recently installed in the steam-electric generating station of the Hawaiian Electric Company at Honolulu brings the capacity of the station up to 37,500 kw. Besides Honolulu, the company serves the plantation pumping load on the island of Oahu. The generator is rated at 11,000 volts, 60 cycles, 1,800 r.p.m., and is driven by a twelve-stage steam turbine designed for 300 lb. steam pressure and 200 deg. of superheat. The turbine, generator and switchboard equipment were supplied by the Westinghouse Electric & Manufacturing Company.

Commercial Committees, N. E. L. A.—The domestic cooking and heating committee of the Commercial Section, N. E. L. A., has been abolished and replaced by the domestic cooking and water-heating committee, of which C. O. Dunten of the Central Illinois Light & Power Company, Springfield, Ill., has been appointed chairman, not A. C. McMicken. R. T. Duncan of the Detroit Edison Company is chairman of the customer relations committee, not F. F. Kellogg, as reported in the issue for October 17, page 813. These corrections should be made in the list there printed.

Pacific Gas & Electric Installs Large Synchronous Condenser.—The 40,000-kva. synchronous condenser recently installed at the Vaca-Dixon substation of the Pacific Gas & Electric Company is said to be the largest of its kind ever built. The new machine, together with two 20,000-kva. condensers already in operation, provides line regulation for the 220-kv. Pit River transmission lines. The new machine is three-phase, rated at 60 cycles, 11,500 volts and 600 r.p.m., with a normal continuous rating of 40,000 kva. at zero leading power factor and 25,000 kva. at zero lagging power factor. When operating at either of these ratings the temperature rise of the rotor will not exceed 60 deg. C., nor that of the field 80 deg. C. The machine was built by the Westinghouse Electric & Manufacturing Company.

Power Rights Sought on Devil's River, Tex.—John C. Kennedy of San Antonio, thought to represent large electric power interests in Texas, has made application to the State Board of Water Engineers for water-power rights on the entire Devil's River. This stream is 175 miles long, flowing through a deep canyon and emptying into the Rio Grande at a point in the upper border region of the state. Mr. Kennedy's application shows that four sites for large dams and reservoirs are contemplated. It is planned to construct transmission systems to towns and industries within a radius of more than 300 miles.

New England Central-Station Women Convene.—Thirty-seven women, representing 1,800 female employees of central-station companies in all parts of New England, gathered at the Hotel Bond, Hartford, Conn., last month to organize the work of the coming year in local companies under the direction of the women's committee of the Public Relations Section, New England Division, N. E. L. A. This is understood to be the first meeting of the kind ever held in the Northeast, and it aroused great enthusiasm. Thirty-two companies were represented, and following a noonday luncheon the entire afternoon was devoted to the active discussion of the relations of women to the central-station industry.

Pacific Coast Commercial Section Discusses Year's Work.—Plans of the Commercial Section of the Pacific Coast Electrical Association, as disclosed at the first executive committee meeting of the section, held in San Francisco October 23, indicate that committee work will be devoted largely to improving selling methods and increasing sales rather than to study and research. Active participation in electric truck sales, industrial heating sales, range and water-heater sales, appliance sales and lighting sales will be fostered. Electric refrigeration will have especial consideration from the appliance committee. A general meeting of all committees of the Commercial Section is to be held in San Francisco on November 19 and 20.

Sparta and Athens, Ga., Seek Better Service.—Enthusiasm for selling the municipal lighting and power plant to the Georgia Southern Power Company was manifested at a recent meeting of citizens of Sparta, Ga., and a proposal to that effect is soon to be submitted to a vote. At the much larger city of Athens, also in northeast Georgia, C. D. Flanigen, president of the Athens Railway & Electric Company, controlled by H. L. Doherty & Company, has just announced negotiations for the interconnection of its lines with those of the Georgia Railway & Power Company, which would insure an abundant supply of power under normal conditions and link the city with the interconnected system of the Southeast.

Chicago Holding Company Buys Four Kentucky Plants.—The General Power & Light Company, Chicago, announces the purchase of four small utility plants in western Kentucky towns—the Calhoun Public Service Company, Sebree Power & Light Company, Slaughters Electric Light Company and the Corydon Light & Power Company. The plants were sold by R. R. Compton of Hardinsburg, Ky., who bought them last June. The purchaser is planning to buy additional companies in the section, extend transmission lines and develop a central power plant. The entrance of the General Power & Light Company brings the number of large companies operating in western Kentucky to three, the others being the Kentucky Utilities Company and the Kentucky-Tennessee Power & Light.

"Customers' Dividend" at Wallingford, Conn.—Because of low operating expenses during the year, in part due to the absence of large repair items, and also to a lower price for energy purchased from the Connecticut Light & Power Company, the lighting department of the Borough of Wallingford, Conn., has declared a "customers' dividend" of 10 per cent effective on all bills not in arrears for the months of October to December inclusive. A. L. Pierce, manager of the department, advises the ELECTRICAL WORLD that this step is taken instead of a horizontal rate reduction because the present favorable conditions of business may not continue indefinitely. The total saving to customers is estimated at about $5,000. The action at Wallingford is of additional interest in view of the recent declaration of a 50 per cent cut in all bills for September consumption to customers of the neighboring Hartford Electric Light Company.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

Associated Manufacturers of Electrical Supplies—New York, Nov. 9-13. F. Nicholas, 30 East 42d St., New York.

Wyoming Utilities Association—Plains Hotel, Cheyenne, Nov. 16-17. R. E. Bengston, Cheyenne.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 16-20. Franklin Overbagh, 411 South Clinton St., Chicago.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 19 and 20. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Society of Mechanical Engineers—New York City, Nov. 30-Dec. 4. C. W. Rice, 29 West 39th St., New York.

American Society of Agricultural Engineers, North Atlantic Section—Schenectady, N. Y., Dec. 10-12. Raymond Olney, St. Joseph, Mich.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Men of the Industry

Luther B. McMillan has been appointed chief engineer of Johns-Manville, Inc., in the department of general engineering and research.

Irwin L. Moore, formerly of Providence, is now connected with the New England Power Company at Worcester, where he will engage in special engineering work.

Russell Randall has joined the engineering staff of the Duquesne Light Company, Pittsburgh. Mr. Randall is a graduate in electrical engineering of the University of Colorado.

Theodore Schou, chief engineer of the Ideal Electric & Manufacturing Company, Mansfield, Ohio, has just returned to this country after a four months' sojourn in Europe.

W. A. Price, formerly superintendent of the Norway district of the Central Maine Power Company, has been transferred to the Augusta district to succeed the late Charles F. Meigs as superintendent.

E. Chapman has been appointed research engineer for the Lincoln Electric Company, Cleveland. Before affiliating himself with this company Mr. Chapman was on the faculty of Purdue University, College of Engineering.

Edward Woodbury has returned to the Los Angeles office of Stone & Webster, Inc., from the Baker River development in Washington to resume his former duties as executive electrical engineer in connection with the addition to the Long Beach steam plant being constructed for the Southern California Edison Company.

Hudson R. Searing, assistant electrical engineer of the United Electric Light & Power Company, New York, sailed on October 31 for a six weeks' visit to Italy, France and England. He will study European cable installation methods, with particular reference to the 132,000-volt cable now being manufactured in Milan by the Pirelli company for the Edison-United system in New York City. This 132,000-volt cable is to be installed during the coming summer between the Hell Gate generating station and Dunwoodie substation.

Philip A. Lang of London, special European representative of the Westinghouse Electric & Manufacturing Company and for many years works manager of the principal plant of the company at East Pittsburgh, Pa., is in the United States consulting with officials of the company in East Pittsburgh and New York. Mr. Lang's primary purpose in his present trip to America, which he had not visited for nine years, is to gain first-hand information of the engineering trend of the country as influencing the activities of his company. He expects to remain here for two months. Mr. Lang left this country in 1906 to assume the management of the British Westinghouse Company at Manchester, England. He had an active part in elevating it to a commanding position in the industrial life of England and remained as its managing director until it was merged with the Metropolitan Vickers Company in 1918. With the consummation of that merger Mr. Lang elected to remain with the Westinghouse organization and was appointed special European representative.

F. B. Steele and E. P. Peck Receive Promotions in Utica

Frank B. Steele, who was named first vice-president and general manager of the Utica Gas & Electric Company, as announced in the October 10 issue of the ELECTRICAL WORLD, has been affiliated with that organization since

F. B. STEELE

1918. During this period of service he has directed extensive additions to the plants and properties of the company, including the steam-electric plant at Harbor Point, which is now well on its way to completion. In addition he has supervised the enlargement of the Washington Street plant and the construction of additional substations throughout the territory.

A graduate of the George Washington University of Washington, D. C., with the degree of E.E., Mr. Steele entered the service of the Westinghouse Electric & Manufacturing Company. Subsequently he went to Dayton, Ohio, where he spent five and one-half years as power engineer of the Dayton Power & Light Company before his connection at Utica. Mr. Steele was serving in the capacity of vice-president and associate general manager before his recent promotion.

E. P. PECK

Emerson P. Peck, who was chosen vice-president in charge of engineering, construction, electrical operation and distribution, has served for several years as general superintendent of the electrical department. Mr. Peck held many positions of responsibility with the Georgia Railway & Electric Company from 1903 to 1918, when he resigned to become technical expert with the Bureau of Standards and the War Department. Shortly after the close of the war he joined the Utica company and has since supervised the extensive activities of the electric department. Mr. Peck is a fellow of the American Institute of Electrical Engineers and has been active in the technical work of the National Electric Light Association, Empire State Gas and Electric Association and other societies.

A. C. Morton, formerly connected with the Missouri Power & Light Company, has been appointed manager of the Gasconade Power Company, with headquarters at Hermann.

Neal K. Barr, formerly connected with the engineering department of the Public Service Company of Northern Illinois, is now affiliated with the Kansas City Power & Light Company.

R. D. Cochran, local manager for the Iowa Light, Heat & Power Company at Alton, Iowa, has been made assistant to the chief engineer of the company with headquarters at Carroll.

B. L. Parker, for the past seven years associated with the sales department of the Western Electric Company, Omaha, has joined the Majestic Electric Appliance Company sales force. He will still make his headquarters at Omaha.

A. J. Houghton, Jr., formerly connected with the engineering department of the Southern California Edison Company at Los Angeles, has severed his connection with that utility to join the Municipal Department of Water and Power, Bureau of Power and Light.

William J. Miller has resigned from the University of Arkansas, where he served as electrical and mechanical research engineer in the engineering equipment station, to become dean of engineering at the Texas Technical College, Lubbock, Tex.

Homer Ludden, formerly in the employ of the municipality at Elkhorn, Wis., has left that place to become manager of the electric properties of the Waupaca Electric Service & Railway Company, recently taken over by the Wisconsin Valley Electric Company.

Fred H. Cook, for the last ten years assistant hydraulic engineer of the Holyoke Water Power Company, has been promoted to be head of the hydraulic department to fill the vacancy caused by the death of Albert S. Sickman. Mr. Cook has been with the Holyoke utility since 1884. **Allan W. Ladd**, who has been with the company five years, has been appointed assistant hydraulic engineer. Mr. Sickman's position as assistant treasurer of the company has been filled by **Ralph A.**

Smith, a graduate of Norwich University, who has been with the company five years in its engineering department. Mr. Smith was previously with the Turners Falls & Electric Company for two years.

Charles Diehm, formerly affiliated with the Philadelphia Electric Company, is now employed by the Electro Dynamic Company of Bayonne, N. J., as assistant to the production manager.

William Harl has been appointed district superintendent of the Southwest Power Company at Wilburton, Okla., to succeed Oscar McDaniel. Mr. Harl has been in the employ of the company for several years.

Malcolm J. Quimby, formerly connected with the distribution department of the New England Power Company at Worcester, has been transferred to Providence as engineering representative in Rhode Island to succeed Irwin L. Moore, who is now in Worcester.

L. F. Riegel, formerly sales manager of the Savanah Electric & Power Company, has been transferred to Richmond, Va., to become sales manager for the Virginia Electric & Power Company. Mr. Riegel has been affiliated with the Savannah utility for the past ten years.

H. E. Barden, who has been connected with the Southern California Edison Company for fourteen years in an engineering capacity, has resigned to accept the position of district representative of the Pacific Coast Building-Loan Association in the Santa Monica Bay District.

Robert W. Lindley has been appointed to the position of manager of merchandise sales of the Puget Sound Power & Light Company, with headquarters in Seattle. Mr. Lindley has been affiliated with the company since 1906 and has served as sales manager for the past ten years.

Walter I. Dolbeare has been appointed manager of the commercial lighting department, Pawtucket division, Blackstone Valley (R. I.) Gas & Electric Company, succeeding F. C. Eteson, who was recently made sales manager of the Keokuk (Iowa) Electric Company.

T. D. Fulford, formerly sales manager for the Baton Rouge Electric Company, has been appointed sales manager of the Savannah Electric & Power Company to succeed L. F. Riegel, who has been transferred to Richmond, Va. Mr. Fulford was assistant sales manager in Savannah in 1923. The properties at Baton Rouge, Savannah and Richmond are under the executive management of Stone & Webster.

William R. McCann has resigned from the engineering and construction division of Stone & Webster, Inc., Boston, to enter the engineering department of the Atmospheric Nitrogen Corporation, Syracuse, N. Y. Mr. McCann is widely known in New England electrical engineering circles, being the present chairman of the Boston Section of the A. I. E. E. and having been engaged with Stone & Webster for the past five years in various electrical investigations, problems of central-station design and development.

C. W. Kellogg President of New Holding Company

C. W. Kellogg, who since 1923 has been investigating the Conowingo development for the Philadelphia Electric Company, has been elected president of the Engineers' Public Service Company with headquarters at New York. After being graduated from the Massachusetts Institute of Technology with an M.S. degree, Mr. Kellogg entered the corporation department of Stone & Webster in 1903. About a year later he was transferred to the Edison Electric Illuminating Company of Brockton as manager and was subsequently in charge of various operating properties in Texas and the Middle West until 1917, when he was made district manager of the Middle West district of Stone & Webster properties. In 1919 he was made division manager of the Middle West district.

Later Mr. Kellogg was asked to take

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C. W. KELLOGG

part in a comprehensive investigation and appraisal of the Interborough Rapid Transit Company and New York Railways Company, and he has since been engaged in various investigations for Stone & Webster, also having charge of local customers' securities sales. Mr. Kellogg has built up a high reputation as an authority on public utility economics and administrative policies and also on hydro-electric developments.

George Barber, who has been connected with the Puget Sound Power & Light Company since 1911, has been appointed sales manager, with offices in Bellingham, to succeed Robert W. Lindley, now manager of merchandise sales, with headquarters in Seattle.

E. L. Hinchliff, formerly manager of the new-business and merchandise department of the Lake Superior District Power Company, is now affiliated with the commercial department of the Middle West Utilities Company, which controls the Lake Superior company, as assistant to C. J. Eaton, commercial manager. Mr. Hinchliff has been engaged in public utility work continuously since 1908, and during that period he has been connected with nearly every phase of the business. It was in 1922 that he took charge of the merchandising and new-business department of the Lake Superior company, having served as its district superintendent at Ironwood, Mich., for four years. Immediately prior to joining the Lake Superior organization he was assistant superintendent of the range division of the Great Northern Power Company, Duluth.

C. V. Allen, formerly manager of the Westinghouse Electric International Company in Mexico, has been elected assistant treasurer of the company, with headquarters in New York City as general assistant to H. A. Carmichael, treasurer. The appointment was effective October 15, according to an announcement from the executive offices of the company in New York. **Clayton T. Rogers**, sales manager for the Mexican branch, has been named acting manager, succeeding Mr. Allen. Mr. Allen has been with the Westinghouse organization for thirty years. Before being made manager of the Mexican branch of the International Company, he had acted as Westinghouse special agent in Mexico. He assumed the managership of the branch division at the time of its organization in 1921. Mr. Rogers, who succeeds him in Mexico City, served as special representative of the company in Peru for two years and then in Monterey, Mexico. He was later made sales manager of the Mexican branch.

Obituary

Albert Franklin Sickman, assistant treasurer and superintendent of the hydraulic department of the Holyoke (Mass.) Water Power Company, dropped dead of heart disease in that city October 17. He was an associate engineer in building the Holyoke dam and succeeded his brother as chief hydraulic engineer of the company.

Charles H. Nettleton, president, manager and treasurer of the Derby (Conn.) Gas & Electric Company, died at his home in that city October 29, in his seventy-fifth year.

Robert E. Hughes, newspaper man, banker and formerly president of the Kentucky Electric Company, Louisville, died October 29 in that city following an operation for appendicitis. A native of Lancaster, Ky., he engaged in newspaper work before being made president of the Kentucky Electric Company in 1908. He served in that capacity until 1913, when the utility was merged with the Louisville Gas & Electric Company.

G. L. Lindsley, pioneer in the Western pole business and chiefly responsible for the introduction of the Western pole into the Eastern market, died at his home in Rockford, Ill., October 23. He was well known to the older men in electric light and power circles and together with his brother, E. A. Lindsley formed the original partnership of what is now the Lindsley Brothers Company of Spokane, Wash., dealers in Western red-cedar poles and Douglas-fir cross-arms. Among the cedar-pole companies G. L. Lindsley was always held in high regard, and the news of his death was received with deep regret by his many friends in the electrical business.

Commission Rulings

National Electrical Code Requirement Upheld.—The Pennsylvania Public Service Commission has approved a rule adopted by the Penn Public Service Corporation requiring electric wiring and equipment installed by the consumer to conform with specifications and regulations of the National Electrical Code. The commission also held that an electric company may require evidence that the wiring and equipment to be connected with its lines are safe and properly installed. A rule compelling a consumer to produce a certificate of inspection from an underwriters' association before connecting its service lines is reasonable and proper for protection of life and property, the commission said.

Bond Issues Up to 75 per Cent of Capital Allowed Under Blanket Mortgage.—The Public Service Commission of Vermont has permitted the Twin State Gas & Electric Company to execute a fifty-million-dollar mortgage in substitution for a prior one in smaller amount, the new mortgage to permit bond issues of different dates, maturities and interest rates up to 75 per cent of the company's invested capital. "As the conditions of the money market change," the commission remarked, "the rate of interest that a bond should bear in order to get the best price in the market will vary. It may be that a bond bearing a larger rate of interest can be marketed to net the company more money at a less rate of interest than a bond bearing a lower rate of interest. These features are beneficial to the company and not objectionable from the point of view of the public."

Flat Rate Superseded by Demand Charge on Two Bases.—Approving the establishment by the Cape & Vineyard Electric Company for a year's trial of a demand charge on two bases in a district including a very large summer population, which had previously been served almost entirely on a flat basis without meter, the Massachusetts Department of Public Utilities said: "The company proposes to create demand or area charges under two items, entitled 'residential lighting' and 'cooking, heating and residential lighting.' These charges seem to rate approximately the amount of investment devoted to the supply of any particular customer. They are based on the number of feet contained in each particular residence. The company's schedules provide, in addition to this, a charge per kilowatt-hour used according to meters. This is to represent approximately the cost of generation and distribution to the consumer. The effect of the plan proposed will be to meter all ordinary service and to charge for it on two bases—one a fixed charge based on area and the other a kilowatt-hour charge based upon consumption. The company's idea is that the area charge is better adapted to the character of its district than is the ordinary minimum or service charge. The company is trying to prevent the waste of electricity. We think the best test is experience. We feel, however, that the company should exercise care to insure its areas being accurate and justly proportioned in order that its plan may have trial under favorable conditions; e.g., finished half stories and finished attics should count only as half floors as was agreed at the hearing."

Extent of Commission's Jurisdiction in Location of Substations.—In granting to the Public Service Company of Northern Illinois permission to erect a substation in a certain location the Illinois Commerce Commission said: "The commission is not authorized to determine or award damages resulting from the taking of land for the location of an electric substation, this being a function of the court, but the commission is solely concerned with the question whether acquisition of the property for public utility purposes is reasonably required by public convenience and necessity. The public need of the electrification of a railroad [the Illinois Central] and the necessity to that project of a proposed substation in a designated location constitute a controlling reason for an order authorizing the construction of the substation and the acquisition of the necessary land, notwithstanding the detrimental effect upon surrounding property, which is restricted to single residences and is in close proximity to certain golf courses and club houses which have been improved and given landscape treatment at great expense."

Recent Court Decisions

Supreme Court Refuses Jurisdiction in Seattle Case.—The United States Supreme Court has denied a writ of certiorari sought by the city of Seattle to have it review a decision of the Circuit Court of Appeals favoring the Puget Sound Power & Light Company. The case reached the Supreme Court on a technical point of law, and the action of the court in refusing to hear it means that the case will be tired on its merits in the lower court. When Seattle took over street-railway lines owned by the company the company insisted that the city pay $301,000 personal property taxes assessed against the company in 1919 by the state and county. The city refused to reimburse the company for the taxes it paid and the company sued. The United States District Court dismissed the bill on the ground that the wrong remedy had been used in law, but the Circuit Court of Appeals reversed this decision.

Narragansett-Attleboro Case to Be Reviewed.—The United States Supreme Court has granted a writ of certiorari sought by the Public Utilities Commission of Rhode Island and the Narragansett Electric Lighting Company to review a decision of the Rhode Island Supreme Court in favor of the Attleboro Steam & Electric Company of Attleboro, Mass. The Narragansett company contracted to deliver energy to the Attleboro company at the state line. In 1921 it attempted to increase the rate. The United States District Court gave the Attleboro company an injunction on the ground that the Rhode Island commission had not granted the Massachusetts company sufficient hearing. New proceedings before the commission started in 1923, and the commission granted an increase. The State Supreme Court declared the action void, holding that the action of the state commission was interference with interstate commerce.

Definition of "Going Value."—In granting an injunction to the New York & Richmond Gas Company against William A. Prendergast as chairman of the Public Service Commission to prevent the enforcement of the "dollar-gas" law of the New York Legislature, the United States District Court for the Eastern District of New York had this to say on "going value," one of the items in dispute: "Going value is the difference between what a prospective purchaser would pay for a fully completed and equipped plant ready to operate, but which in fact had never operated, and one fully completed and equipped which is actually operating with an established business as a going concern. The dominant and relevant fact in determining going value is not original cost or expense of acquisition, but rather the actual present value of the elements now owned and possessed, and the present replacement of these elements, if they were not already possessed, is an important factor in weighing their present worth. Each case has to be considered on its own facts in determining going value, and percentages from other cases are not precedents except to demonstrate the trend of decision and to check the figures. An allowance for going value should not be reduced because of the fact that the present company did not itself build up and acquire all of the intangible elements of going value now possessed and used by it, but purchased a part of the property, along with the plant and distributing system, from predecessor companies."

Contributory Negligence Involved in Using Short Ladder Bars Recovery for Death Due to Shock.—In Hoke vs. Edison Light & Power Company damages were awarded for the death of a workman who came in contact with electric wires alleged to be insufficiently insulated and fell to the ground while engaged in repairing a spout on one of the company's buildings, it being asserted that no warning of the proximity of the wires had been given. The Supreme Court of Pennsylvania has reversed the finding on the ground that the victim of the accident was killed through his own negligence, he having selected a ladder too short for the task he was undertaking and having grasped the wire in an attempt to regain his balance when he overreached himself. One judge dissented from the finding. (130 At. 309.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Trade Association Function Chiefly Statistical

Opportunities and Responsibilities Also Discussed at Meeting of Academy of Political Science

"ONE, if not the chief function of trade associations is the collection of more and more statistics. The collection of such statistics is a marked step in advance and in the progress of economic affairs," said Robert S. Bookings, president Institute of Economics, Washington, in an address given at the annual meeting of the Academy of Political Science held in New York on October 28. Continuing, this speaker pointed out that the drawback has been not that too many statistics have been obtained, but rather too few. Blind competition has created a wide fluctuation in supply and demand, and ignorant competition is one of the most demoralizing influences in industry. The benefits of competition must be obtained without these ill effects, which can be overcome by statistical data which shall have the widest publicity.

Other speakers stressed the facts that production data can be gathered only through co-operative effort and that fully informed buyers and sellers will act less erratically. The various addresses dwelt largely on the necessity for intelligent co-operation among the large and small units of industry and the necessity for collecting statistics to stabilize and benefit industry.

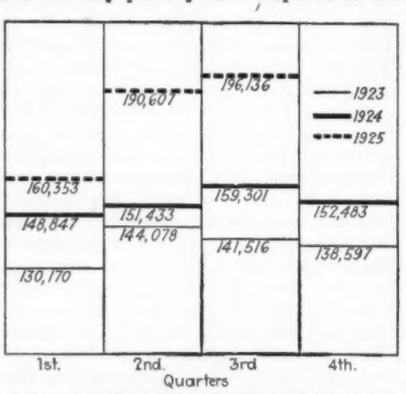
The new opportunities and responsibilities of trade associations under recent Supreme Court decisions were the subject of a paper presented by Gilbert H. Montague of the New York bar. "The courts, the administration and the public are today more friendly toward trade associations, business combinations and business generally than they have been at any time since the first anti-trust laws were enacted, nearly a generation ago," said Mr. Montague. "Business stability, greatly exceeding anything previously realized, will soon become a glorious reality if trade associations and business men will utilize all the opportunities and scrupulously fulfill all the responsibilities that the present situation has created.

"Intelligence, the Supreme Court declared, is not necessarily a crime. Business men who, in the exercise of their sound independent judgment, avoid the accumulation of surplus stocks, abstain from ruining one another by cut-throat competition, and intelligently seek to produce, to distribute and to sell, with some rational conformity to the state of the market, should not, the Supreme Court held, be treated as criminals. Intelligent, rational business conduct, the court said, does not become a crime, even though it be based upon trade information and trade statistics gathered and disseminated by a trade association, and even though such information and statistics tend to stabilize industry and to bring about fairer price levels.

"If trade associations, business combinations and business men, big and little," said Mr. Montague, "will continue during the next few years to give signal demonstration to the courts, the administration and the public that the confidence reposed in them by Secretary Hoover and by the Supreme Court has not been misplaced, the present sympathetic attitude toward business may, eventually, become a national habit. This prospect presents enormous opportunities to trade associations and business men in every branch of American industry. Business can be maintained on present or even better levels, peaks of overspeculation can be cut down, valleys of undue depression can be filled up, extremes of feast and famine can be avoided, and industry can, with reasonable assurance, be stabilized on fairer price levels.

Sales of Washing Machines Largest Ever Recorded

Sales of electric washing machines during the year 1925 to date are larger than in any prior year. Reports of the number of units sold in the first three quarters of this year show an average increase of about 31 per cent as compared with 1923. Indications are that business during the last quarter of this year, as well as the early part of next year, will continue at a high rate and will set a new record.



SALES OF ELECTRIC WASHING MACHINES BY QUARTERS, 1923-1925

Despite this increase in sales, however, the market for electric washing machines is extending faster than the present rate of sales owing to the large increase in wired homes. An active trade-in business is reported by dealers, and merchandising methods are becoming more efficient as compared with only a year ago. Large sales are being made by dealers and department stores whose business is being transacted without outside solicitation.

Distribution of Goods Higher in Eastern Atlantic States

Distribution of goods at wholesale and retail in the Eastern Atlantic States for the last quarter this year will show an increase of from 10 to 15 per cent over the corresponding period of 1924, according to an analysis compiled by the Atlantic States Shippers' Advisory Board. The board's survey was based on forty commodity reports covering all of the basic industries in its territory.

This district comprehends New York, New Jersey, eastern Pennsylvania, Maryland, Delaware, eastern Virginia and the District of Columbia. "The board's survey of business conditions" said W. J. L. Banham, general traffic manager of the Otis Elevator Company and general chairman of the board, in making public the report, "is of necessity one of the closest check-ups of the trend of industry which is now produced. It is based on accurate estimates which the various industries make as to their car requirements for the next ninety days. These reports are collated by the American Railway Association as they come in from each of the twelve shippers' advisory boards of the country, and in this way the transportation needs of various localities can be anticipated."

Increased production is expected in the following industries, it is shown in the analysis of the Atlantic States board: Automobile, chemical, confectionery, fertilizer, leather, milk, paint and oils, cordage, paper and pulp,

SALES OF WASHING MACHINES BY QUARTERS 1923-1925 (EXCEPT ELECTRICS)

Electric Washing Machine Sales Shown Separately

(Data Supplied by American Washing Machine Manufacturers' Association)

Quarter	Hand-Power Machines			Gas and Power Machines			Water-Power Machines			Total Including Electric Machines		
	1923	1924	1925	1923	1924	1925	1923	1924	1925	1923	1924	1925
First	35,317	22,079	25,174	5,934	3,803	6,762	7,352	4,732	5,475	178,773	179,461	197,764
Second	30,811	20,470	25,314	6,319	4,301	9,034	7,758	4,023	5,844	188,966	180,227	230,799
Third	20,212	19,036	22,348	4,289	3,987	10,431	6,947	5,078	5,665	172,964	187,402	234,580
Fourth	19,063	20,748	.....	3,568	4,842	.....	6,498	3,729	.....	167,726	181,802	.....

petroleum and petroleum products, tobacco and building materials. No change in car requirements is expected for the next three months in these industries: Canned goods, clay and clay products, glass container, lime and gypsum, machinery, storage and warehouse, and textiles.

Reducing Machinery Development Costs

Bridging Gap Between Experimental and Mass Production Will Prevent Development Costs from Overshooting Period of Preliminary Design and Tryout

BY "OBSERVER"

IN THE electrical industry it has long been the practice to produce new designs of apparatus for preliminary testing and use on a small scale before such equipment is marketed on a mass output basis. The wisdom of such a course is self-evident, but not so apparent from the purchaser's viewpoint is the magnitude of the development cost; and often, indeed, such expense far exceeds the anticipated outlay on the part of the manufacturer. In the interest of all it is vitally essential that once a new or improved line of apparatus is ready for marketing on a large scale, judging from its performance in experimental and other preliminary installations, the time and facilities needed to bring the product into normal production and sale shall be reduced and planned in such a way as to eliminate all possible losses. No greater skill is demanded from the manufacturing production engineer and his executives than that required to keep development costs from overshooting the period of preliminary design and tryout. It ranks in many cases with the skill of the designer himself and has a direct bearing upon the profits of the factory and the ability of the organization to sell at prices which will attract business.

MAJOR PROBLEM IN CO-ORDINATION

Here is a major problem in co-ordination. To solve it efficiently requires an understanding of the design as a contribution to the progress of the art on the part of every branch of the organization concerned with the production and marketing of the equipment. Nay, more; it demands what might be called a synchronous appreciation on the part of the related departments of the progress of the development toward the complete commercial stage, and with this, collateral planning for future mass production and the preparation of a complete program of sales activity, tied in with the factory's work and the field service record of the advance guard of apparatus which makes or breaks the victory of the line. Too often the costs of bridging the gap between the experimental period and mass production and sales are allowed to climb out of all reason through lack of vision on the part of the organization, resulting in a policy of drifting along until the market accelerates out of its own momentum and forces rush plant and raw-material outlays that should have been anticipated before a flood of orders overtaxes too meager facilities and strains the entire set-up.

On the one hand are the designing engineers putting the finishing touches to the development. On the other are the sales forces, probably restrained from taking orders until the release of the line is announced, and between these are the regular production facilities and personnel, often knowing little or nothing about what is soon to be assigned them for regular output. It is, or should be, obvious that all these branches should be kept posted on the development as it proceeds and that a part of their constant duty is to prepare plans for meeting the problems of mass production as these approach. This means regular information about the progress of the design, the behavior of the initial units on the test floor and in the field, and official indication as to the tentative dates when active preparations can be made for step-by-step large-scale output. Such dates may be moved along with great frequency as designs emerge out of trial applications into the class of standardized installations; but the time element is of such enormous importance in getting out new products or improvements on old ones that the most conscientious efforts should be made to anticipate the dates of embarking on normal production, even where these have to be changed as often as once a week.

Naturally plant executives cannot authorize large expenditures for jigs, patterns and machinery for the production of a new motor, for example, until preliminary trials of a severe order point the way toward successful service. But the market can be analyzed with as much thoroughness as possible within the limits of the budget of the development and the facts assembled, studied and co-ordinated with respect to plant requirements. It may cost hundreds of thousands of dollars to put a new or greatly improved motor on the market. This must be done soberly, discreetly, advisedly and in the fear of inadequate knowledge of the entire situation. In this work some one should be responsible for cutting out waste and lost motion.

The old habits of letting each department shift for itself and confine its attention to purely routine tasks must give way to a newer method, viz., keeping all concerned informed as to the progress of the development far in advance of large-scale output. This means getting bids on new machinery, if required, long before the seal of final success is stamped on the product; it means preparing organizations on paper to function in the shortest reasonable time after the word is given to go ahead; it means perfecting the entire plan of campaign from the drafting room to the most remote sales office so that time shall not be lost after the outcome of the development can be guaranteed by the technical and executive staff. It means more consideration of the value of advertising forthcoming products farther in advance of their date of mass appearance, so that the entire market can be familiarizing itself with what is coming, and in many cases it may mean the encouragement and acceptance of preliminary orders for initial deliveries at stated times, thus enabling demands to be more accurately forecast in the transition period and physical preparations pushed at an earlier date.

CO-ORDINATION FORESTALLS LOSSES

Once the success of a product is seen to be certain, every effort should be bent upon co-ordinating the agencies that are to put it in its place in the sun of industry favor, and to sum up the whole problem and the approach to its solution in a few words, one may say that by co-ordinating information and resources continuously and by planning flexibly at every step, the manufacturer can work wonders in forestalling losses due to ignorance of what is under way, delays in preparing for new facilities, overcaution or inertia in publicity and sales activity, and failure to visualize engineering and market conditions.

Business Conditions

FROM the standpoint of volume there is a remarkable demand for wire and material, particularly in the Atlantic States and Middle Western territory. Large increases in the sale of these goods are reported. Central-station companies are purchasing watt-hour meters, transformers and other distribution material at a rate above the average, and industrial plant buying is in large volume. The business transacted is steady and there is no indication of overbuying.

Sales of motors continue in good volume, with machine-tool and appliance manufacturers placing many orders. Several motor manufacturers report that orders received during October were better than for the same month last year, and the tendency is for sales to increase. An indication of general business is furnished in the reports of two of the leading mail-order houses of the country, which show remarkable gains in sales during October. Production in the steel industry is increasing, and orders are better than at any time in the last six months.

In New England sales show a steady trend. Many orders for transformers were reported, as well as good sales of voltage regulators, one amounting to about $25,000, and a strong demand for small motors is noted. Sales in the New York district continue in good volume. Distribution material is in

strong demand by central-station companies, industrial plants are buying actively, and sales of wire sockets and other wiring material are conservatively estimated at 30 per cent above those for the same period last year. Conditions in the Southeast are steadily improving, with the bulk of orders for electrical material coming from Florida. Additional rains in that territory have permitted power companies to notify their customers to resume normal operations, which factor alone will probably serve to stimulate retail trade. Good business is continuing in the Middle West, and the outlook is very encouraging. Construction work by the various utility companies in that territory is being hurried to completion and distribution equipment is much in demand. On the Pacific Coast good sales throughout November are predicted, power-company buying is good, and lumber company purchases are distinctly better, with fairly large machinery sales reported in northern California and southern Oregon.

Copper, Lead and Zinc Advance —Buying in Good Volume

THE strength in the non-ferrous metal market continues and the prices of copper, zinc and lead have all reached new high levels. Zinc is perhaps the strongest of the three, climbing close to 9 cents, St. Louis, for prompt shipment. Lead again resumes its upward trend after being held around 9¼ cents, New York, for two and a half months. Copper again nears 15 cents, delivered, being at about the level that it was in the middle of September. Most of the copper sold is for either December or January shipment, with a fair sprinkling for November. Two or three producers are somewhat more anxious to sell nearby copper than forward, but they have not a great deal on hand. Monday was the best day of the week in point of tonnage booked. Practically all of the sales that day were made on a basis of 14¾ cents, delivered to nearby points and Connecticut, and 14⅞ cents to less favorably situated plants. Wire and brass mills continue to be heavy buyers, and their excellent business seems to show no signs of a let-up.

After maintaining its official contract price for New York lead at 9.50 cents since August 26, the American Smelting & Refining Company advanced to 9.75 cents on Monday, November 2. The smaller producers had been getting premiums for several days. Supplies were inadequate, however, to take care of all comers, and when contracts had to be limited the outside market naturally stiffened. Neither of these large producers are sold out of lead, even for November, but they are forced to limit outgo until they know exactly what production is to be. No great demand for spot is in evidence, nor for shipment as far forward as January either. Most of the calls are for November and December shipment, indicating that consumers have moderate stocks and are not anxious to increase them greatly at the present high levels. That lead is scarce is evident from the fact that inquiries are coming in from unusual sources. The zinc market is practically unchanged and little interest has been exhibited in tin.

NEW YORK METAL MARKET PRICES

	Oct. 28, 1925 Cents per Pound	Nov. 4, 1925 Cents per Pound
Copper, electrolytic	14⅝	14⅞
Lead, Am. S. & R. price	9¼	9¾
Antimony	18¾	20
Nickel, ingot	34	34
Zinc, spot	8.80	9.20
Tin, Straits	63	62¾
Aluminum, 99 per cent	29	29

Base copper price Nov. 4, 1925, 16½ cents

Business Very Satisfactory in New York District

CENTRAL-STATION companies in the New York district are purchasing distribution materials in large volume. There are no spectacular orders, but buying is steady and is considered above normal. Some interesting orders are in prospect for generating and substation equipment. Industrial plants continue to buy motor and control equipment, and sales to machine-tool and appliance manufacturers are good. Wire and cable is in strong demand largely owing to a strong metal market, and business in general is looked upon as moving at a very satisfactory rate.

The demand for wire and wiring supplies, such as conduit, sockets, etc., has been particularly good. It is estimated that present sales are high enough to warrant the statement that jobbers' business in this district will be 25 per cent above that transacted in the same period last year. There has been a slight check this week since September 1, but indications are that this is only temporary. Appliances are also reported to be in very good demand.

Conditions in the Southeast Improving Steadily

GENERAL conditions throughout the Southeastern territory are improving steadily. Additional rains over the Southeast have permitted power companies to notify their customers to resume normal operations, and this factor alone will serve to stimulate retail trade as a number of industrial plants were unable to operate on night schedule and their labor was only partly employed as a result. Florida continues to lead all the Southeastern States in the volume of purchases of electrical materials. However, the strict embargoes on all freight into Florida, except perishables and foodstuffs, is causing considerable difficulty in deliveries after the orders are received, and this will result in a slowing up of activities in that state to some extent. New Orleans, while somewhat quiet at this time, holds better prospects than for some years past.

Vacuum - cleaner sales improved sharply with the advent of fall, and one manufacturing firm states that its October sales amounted to more than eight hundred machines in this territory, which is the best month in the history of this district office. About 75 per cent of these sales were made through central-station companies.

Good Sales Throughout November Predicted on Pacific Coast

BUSINESS which slowed up a little on the Pacific Coast during mid-October has markedly increased during the past week and good sales in November are predicted. The value of San Francisco building permits for October was $4,351,249, which compares with $6,116,313 for the same month last year. Power-company business is excellent, particularly from the San Joaquin district, the following inquiries being mainly from that section: 15,000 lb. Nos. 2 and 4 weatherproof wire, 1,400 steel cross-arms (110 kv.) and 600 for 66-kv. service, amounting to $20,000 for plain and $25,000 for galvanized; 15,000 fuse plugs, 1,500 large non-renewable fuses, 1,200 lb. magnet wire, three carloads 35-ft. poles and 1 gross assorted line tools.

It is estimated that about 500 electric ranges were sold during the past two months in northern and central California. Another campaign—that for the sale of kitchen-lighting units—is exceeding expectations. Increased activity is reported in equipment purchases by electric traction companies in the San Francisco Bay area. Oil-company buying even of maintenance supplies is very light, although one lamp contract for $20,000 is reported. Lumber-company purchases are distinctly better and have resulted in many fairly large machinery jobs in northern California and southern Oregon.

Sales Show Steady Trend in New England District

OUTSTANDING in a steady movement in the electrical trade in New England is an encouraging activity in transformers, with the receipt of over one hundred orders recorded by one manufacturer during the past week, a resumption of voltage-regulator sales, of which a number of orders—including one amounting to about $25,000—are reported, and continued strong demand for small motors. Switches, control apparatus and watt-hour meters are also selling well. Electrical supplies for building construction continue to show a strong trend.

Plans for the introduction of electric motive power on steam railroads are attracting attention. The Boston & Maine Railroad has received a portion of a large order, consisting of twelve gasoline-engine passenger cars equipped with a 600-volt generator coupled to a standard 140-hp. railway-type motor. The Maine Central Railroad recently appointed a committee which will report on the feasibility of electrification of its main line. Electrical appliances for household use are active. One central-station company reports 167 recent installations of refrigeration units in apartments. This same company also records increased activity in the demand for electric ranges, flatirons and other appliances. The Gloucester Electric Company plans to expend about $150,000 for new equipment and plant extensions, and the New England Telephone & Telegraph Company has authorized the expenditure of $4,793,930 for new construction work.

Good Business Continuing in the Middle West

EVIDENCE that the good business period entered into in the fall is continuing is seen on all sides in the Middle West. Construction work by the various utility companies is being hurried to completion and distribution equipment is much in demand. Sales of energy for power use are increasing rapidly, causing an unusual demand for large watt-hour meters. In the Chicago district there are orders on hand for twelve 4,000-volt transformer vaults, which represent an unusual demand at one time. Several large orders for disconnecting switches, circuit breakers, relays, transformers, etc., together with an order for ten motor-generator sets, were placed this week, while there has been an excellent demand for cable, poles and pole-line hardware.

Jobbers' sales are increasing. There has been a steady increase in the volume of business transacted, and the outlook is very encouraging. Appliance sales are good, and practically all appliances are moving well. One large group of jobbers states that washing-machine sales thus far this year are 57 per cent ahead of the sales for the same period last year. Reports from several utility companies doing merchandise business throughout the greater part of Iowa indicate a steady and consistent gain in merchandise sales over 1924, amounting on the average to approximately 20 per cent.

Activities of the Trade

Trumbull-Vanderpoel Announces New Distribution Facilities

Since November 2 the interests of the Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., in the New York metropolitan district will be handled by the Ingham-Gillingham Company, 51 Barclay Street, succeeding the Frederick Rall Company, Inc. The company states that a complete stock of Trumbull-Vanderpoel standardized meter switches, industrial switches and knife switches, representative of its complete line, will be carried at the above address for the convenience of distributors. The new company consists of George V. W. Ingham and George J. Gillingham.

Conlon Corporation Reorganizes Sales Force

The Conlon Corporation, Chicago, manufacturer of Conlon electric clothes washers, announces that its sales force was recently reorganized and some territories redistricted as follows: E. S. Goodin has been appointed division manager covering the northwest Pacific Coast with headquarters at Portland, Ore. H. F. Barger, with headquarters at San Francisco, Cal., is division manager covering the southwest Pacific Coast. F. M. Johnson as division manager covers the southwestern territory east of Wyoming, Colorado, New Mexico and all territory west of and including southern Kentucky, Tennessee and Mississippi, with headquarters at Oklahoma City. Mr. Johnson has two district managers assisting—Mr. Cunning, working out of St. Louis, and Mr. Trevor, working out of Evansville, Ind. W. H. Hall as division manager operates in the western counties of Pennsylvania with headquarters at Pittsburgh. P. H. Kelley is division manager for New York State, excluding the three extreme southeastern counties, with headquarters at Buffalo. J. G. Nerad is division manager for eastern Pennsylvania with headquarters at Philadelphia. E. I. Foley has been appointed assistant sales manager with headquarters at Chicago. The company also states that it now has a large force of resale managers in the field co-operating with dealers in building up resale organizations.

Use of Arc Welding in General Electric Manufacture

Arc welding has been used at the various works of the General Electric Company for several years past with marked success. Its introduction has been responsible for a change in design of some of the lines of apparatus whereby arc-welded boilerplate has been substituted for cast iron. In a great many cases, electric welding has taken the place of gas welding, effecting considerable saving.

For instance, in 1913 in one of the factories, twelve arc welders were being used on thin sheet-steel ($\frac{1}{16}$-in. and $\frac{3}{32}$-in.) transformer tanks. The seams were welded by means of carbon arc, there being no metallic electrode holders employed at that time. Today the same factory has fifty-seven arc welders, fifty-two of these using metallic electrode and five using carbon electrode. Each month they consume more than 1,000 carbon pencils, 13,500 lb. of welding wire and 40,000 kw.-hr. of electrical energy and accomplish 67,500 ft. of welding. Arc welding is at present being used on the following different lines of apparatus: Transformers, locomotives, motors, generator stator frames, miscellaneous structural iron, cast iron and steel castings, miscellaneous shop equipment, switchboard supports, furnaces, mercury boiler, arc lamps, rectifiers, compressors, high-pressure oil pipes for turbines, building up shafts, copper hydrogen brazing furnaces, wire-enameling machines, flow-meter nozzles and jigs and fixtures in addition to miscellaneous other items.

Southern California Edison Purchases Transformer Equipment

Anticipating the need for additional capacity in its Eagle Rock substation when the third Big Creek-Los Angeles 220,000-volt transmission line is completed, the Southern California Edison Company has placed an order with the Westinghouse Electric & Manufacturing Company for four 25,000-kva., 220,000 - 60,000-volt transformers. The Westinghouse company also received an order for twenty oil circuit breakers for use on this system, as reported in the October 31 issue of the ELECTRICAL WORLD.

The Riley Stoker Corporation, Worcester, Mass., has appointed the Engineering Sales Company, Inc., 640 South Peter Street, New Orleans, as sales agent for Louisiana, southern Alabama and southern Mississippi, including the cities of Jackson, Meridian and Vicksburg.

Black & Decker, Towson, Md., announce the addition of a heavy-duty $\frac{1}{4}$-in. portable electric drill to their line of portable electric tools.

The Western Electric Company has moved its office in Denver from 1425 Curtis Street to Eighteenth and Blake Streets, where a building has been converted for use as an office and warehouse. The new location is in the wholesale district, has trackage facilities and consists of two stories and basement with approximately 20,000 sq.ft. of floor area.

The Pittsburgh Electric Furnace Corporation, Thirty-second and Putney Streets, Pittsburgh, is now offering a new model, known as the "Senior" model of the "Edmoore Demand Limitator"—an electrical device for automatically controlling maximum demands or peak loads on electric power systems.

The Electrical Manufacturing Company 4149 East Seventy-ninth Street, Cleveland, manufacturer of cabinets, panel boards and switchboards, has awarded a contract for the erection of a one-story plant addition, 50 ft.x100 ft.

The Tubular Woven Fabric Company, Pawtucket, R. I., announces the opening of a Detroit office in the General Motors Building. Russell Wherritt, formerly with the Spaulding Electric Company, has been appointed district manager and will cover Michigan, Indiana and northwestern Ohio.

The General Electric Company announces the removal of its offices in Oklahoma City to the Colcord Building, 15 North Robinson Street.

The Pacific Electric Manufacturing Company, San Francisco, manufacturer of high-tension switchgear, announces the opening of its own branch office at 1001 McCormick Building, Chicago, which will be in charge of G. B. Kirkwood, who has been connected with the engineering department of the company for several years.

The Air Preheater Corporation, 25 Broadway, New York, manufacturer of the Ljungstrom air preheater, is a consolidation of James Howden & Company of America, Inc., and the Ljungstrom interests of Stockholm, Sweden. The newly formed corporation takes over all Ljungstrom patent rights of the preheater, together with the shops of James Howden & Company of America, Inc., at Wellsville, N. Y.. B. G. Brolinson has been elected president of the corporation and W. L. Batt, president of S K F Industries, is chair-

man of the board of directors. The corporation states that it has orders on its book, placed by many large utility and industrial companies, amounting to approximately $1,000,000, for Ljungstrom air preheaters.

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., and the **Champion Switch Company**, Buffalo, N. Y., which are associated organizations, have appointed two new agents in the Western territory. The D. L. Hearn Company, Langan-Taylor Building, St. Louis, is representing the companies in St. Louis and surrounding territory, and the L. J. Osborne Sales Company, 432 Dwight Building, Kansas City, Mo., is covering Kansas City and surrounding territory.

Porter & Ross, Inc., 30 Church Street, New York, announce the opening of a branch office in the Coal Exchange Building, Wilkes-Barre, Pa., in charge of Neil Cheshire. This company acts as sales agent for the American Enameled Magnet Wire Company, the Eureka Copper Products Corporation, the Green Equipment Corporation, the John C. Dolph Company, the Dutchess Insulation Company, the Mutual Foundry & Machine Company, the Specialty Device Company and the Kaniksu Cedar Company.

The Delco Light Company, Dayton, Ohio, has received orders for more than $2,000,000 worth of "Frigidaire" ice-cream cabinets from two large ice-cream manufacturers, according to an announcement by E. G. Biechler, president and general manager.

The Westinghouse Electric International Company has just received an order from the Amtorg Trading Corporation, the commercial representatives of the Russian soviet government in America, for twenty-five mine locomotives to be used in connection with the electrification of the coal mines in the Donetz District, near the Black Sea, in Russia. Part of these locomotives will obtain their power from trolley wires, and the remainder are of the storage-battery type. A distinctive feature is that they will have adjustable wheel gages so that they can be operated on tracks from 24 in. to 30 in. wide.

The Standard Steel & Bearings, Inc., Plainville, Conn., announces that it is now changing over the specifications of the balls in its bearings from chrome alloy to molybdenum steel, which it is said produces longer bearing life and greater capacity.

The Line Material Company, South Milwaukee, Wis., announces that Nelson S. Moore has joined the staff of the company and will take charge of the sales on high-tension equipment exclusively.

The Commercial Truck Company, 300 Hunting Park Avenue, Philadelphia, has recently delivered thirty electric trucks to the Borden Farm Products Company of Illinois for use in Evanston, Ill. These trucks will replace horse-drawn equipment.

The Westinghouse Electric & Manufacturing Company announces that it has placed on the market a new commercial electric range of especial interest to restaurant owners and hotel managers. The heating elements of the range are said to be of heavy construction, and those of the cooking top are embedded in cast-iron plates in such a way that they are completely protected.

The Delco-Light Company, Dayton, Ohio, manufacturer of the "Frigidaire" electric refrigerator, Delco farm-lighting plants, etc., announces the appointment of W. Leonard Thompson as head of a new statistical division in the sales department. Mr. Thompson was formerly with the Department of Commerce.

The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, manufacturer of pole-line hardware, line material, lightning arresters, etc., announces that its Chicago office has been moved from the Monadnock Building to the Illinois Merchants' Bank Building, 230 South Clark Street.

The Condit Electrical Manufacturing Corporation, South Boston, Mass., announces that Henry Nixon, 509 Mutual Building, Kansas City, Mo., has been appointed as its representative in the Kansas City district, which includes the western half of Missouri and the state of Kansas.

The American Engineering Company, Philadelphia, manufacturer of "Taylor" stokers, "Lo-Hed" electric hoists and other machinery, announces that its interests in Canada have been taken over by the Affiliated Engineering Companies, Ltd., with headquarters in the Southam Building, Montreal. This company has been formed by the merger of the Taylor Stoker Company, Ltd., of Montreal and the Cleaton Company (Canada), Ltd. M. Alpern, president of the American Engineering Company, is chairman of the board of the new company and F. S. B. Heward is president.

The Uehling Instrument Company, 473 Getty Avenue, Paterson, N. J., manufacturer of power-plant instruments, has recently appointed Ernest E. Lee Company, 115 South Dearborn Street, Chicago, as representative in northern Illinois and northern Indiana. The company also announces that P. J. Riccobene has recently joined the home office sales organization, and that the Coon de Visser Company, which has been its representative in Michigan for several years, has just moved from 1772 West Lafayette Boulevard to 251 West Lafayette Boulevard, Detroit.

The Midwest Air Filters, Inc., and the **Midwest Steel & Supply Company, Inc.**, announce their removal from their present New York headquarters, at 100 East Forty-fifth Street, to Bradford, Pa. A branch sales office will, however, be maintained at the New York address. The companies state that this move is intended to concentrate all effective personnel at the factory proper, in order to consolidate organization, eliminate duplicate effort and maintain a closer control of company activities.

New Equipment Available

Vertical Worm Reduction Gear

A worm reduction gear for vertical-shaft drive has recently been developed by the De Laval Steam Turbine Company, Trenton, N. J. The gear casing supports the worm bearings and also the lower bearing of the driven shaft, while the upper shaft bearing is held by the casing cover. The oil is carried at such a level that the worm and gear wheel dip into it, thus insuring copious lubrication. To provide oil for the upper wheel bearing and thrust plate, a small reciprocating oil pump is incorporated in the casing cover. For larger-size reductions, where the worms run at fairly high speeds, it is not desirable to immerse the worm and wheel on account of fluid friction, so that a positive pressure oiling system is used to feed oil to all the bearings and to the worm threads and gear teeth at the contact points. A full line of these drives is made, and drives can be had with the shaft extending either upward or downward.

Cable Support—A cable support for supporting vertical feeders and requiring no special tools has been placed on the market by Brown, Strickler & Brown, 108 North Jefferson Street, Chicago. The device is installed by placing it between the cables and permitting it to drop into position, the cables being pulled into the conduit before the support is placed in position. The cable support is smaller in diameter than the ordinary lock units and bushings so that there is no need for special work in spacing the conduits.

Speed-Indicating Relay

A speed-indicating automatic relay, designed primarily for use with small low-speed vertical waterwheel generators operating under full automatic or remote supervisory control systems, has recently been placed on the market by the Westinghouse Electric & Manufacturing Company. While designed primarily for low-speed operation, it may also be used for high-speed applications and on either vertical or horizontal machines. The relay operates on the centrifugal principle and assists other relays and contactors in controlling the station.

The device is said to be exceedingly flexible and can be used on machines having any speeds between 75 r.p.m. and 900 r.p.m. by changing the size of the weights and the spring tensions against which they operate. For any given generator and relay precise adjustment to the actual speed desired can be made by shifting the stationary contacts, held fast in horizontal slots. All contacts are of chemically pure silver. The accuracy of the instrument is said to be well under 5 per cent. The relay is mounted directly on the end of the rotor shaft, which on most waterwheel generators is at the top, and is inclosed in a sheet-metal housing having a removable top for inspection.

New Trade Literature

STANDARDIZED SUBSTATIONS. — A bulletin describing the Delta-Star net-price standardized substation has been issued by the Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago. The bulletin covers the specifications of the company's unit-type standard outdoor substations and contains dimension diagrams of the different types. The net prices of these units are included.

BAKELITE MEASURING MACHINE.—A leaflet describing the new Stokes' "bakelite" measuring machine, designed to measure charges of "bakelite" and other molding materials preparatory to placing them in the hot molds, has been issued by the F. J. Stokes Machine Company, Tabor Road at Cedar Grove Station, Philadelphia.

SWITCHING EQUIPMENT FOR AUTOMATIC RAILWAY SUBSTATIONS. — A pamphlet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes in detail the various operations of the individual units of the control system entering into the conversion of a substation to complete automatic control.

SAFETY SWITCHES.—The Super-Safety Switch Company, 1219 West 103d Place, Chicago, is distributing a folder covering its new line of "Super-Safety" electric switches.

MECHANICAL MOTION AND ELECTRICALLY OPERATED RECORDERS.—Catalog No. 1,600 issued by the Bristol Company, Waterbury, Conn., describes and illustrates the Bristol mechanical motion and electrically operated recorders for use on all kinds of industrial operations, including machinery, elevators and hoists, conveyors, etc. It contains a chart of an electric operation record, a few methods of applying mechanical motion recorders and wiring diagrams for an electrical operation recorder.

ADJUSTABLE ELECTRIC LIGHT FIXTURES.—Catalog No. 26 issued by the O. C. White Company, Worcester, Mass., describes and illustrates the White adjustable electric light fixtures in applied illumination for domestic, industrial and mercantile service, also fixtures for hospitals, factories and drafting tables, etc. It also contains a section giving information for illuminating engineers and salesmen pertaining to the White adjustable fixtures.

PORTABLE TIMING DEVICE.—Bulletin No. GEA-101 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its portable timing device for use in laboratories and power companies having standard clocks, instead of time clocks, also with graphic instruments, revolution counters, etc.

BALL AND ROLLER BEARINGS.—The Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, is distributing bulletin No. 4,000, covering the various types of ball and roller bearings used with Reliance motors for direct and alternating current. Tables of bearing sizes for Reliance motors and also dimensions are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Sydney, Australia (No. 17,530), for electrical equipment for automobiles; (No. 17,523) for electrical apparatus, engine and boiler accessories.

Purchase or agency is desired in Zurich, Switzerland (No. 17,517), for electrical equipment for automobiles.

Purchase is desired in Vienna, Austria (No. 17,527), of household and office electrical appliances, rubber and fiber insulating material. An agency is desired (No. 17,529) for rubber and fiber insulating material.

Purchase is desired in Sitiawan, Malay States (No. 17,528), of electrical household appliances and electric household refrigerators.

An agency is desired in Berlin, Germany (No. 17,549), for lighting apparatus and turbines, boiler-room equipment and refrigeration equipment.

An agency is desired in Buenos Aires, Argentina (No. 17,510), for self-contained lighting sets.

An agency is desired in Melbourne, Australia (No. 17,509), for electric toasters and large waffle irons. Purchase or agency is desired (No. 17,508) for dental and surgical appliances and supplies, especially electromedical appliances.

An agency is desired in Funchal, Madeira (No. 17,541), for radio sets and parts.

Purchase is desired in Montevideo, Uruguay (No. 17,500), of lead-covered and rubber-covered wire and bare copper wire; also of three elevators and equipment, including installation (No. 17,505).

TENDERS ASKED FOR POWER-PLANT EQUIPMENT FOR SYDNEY, AUSTRALIA. — Specifications have been issued by the Municipal Council of Sydney, Australia, according to *Commerce Reports*, inviting tenders until Feb. 1, 1926, on six steam turbine units and accessories, together with transformers, switchgear, etc., for the construction of a 150,000-kw. power plant in the city of Sydney. The cost of the entire project is estimated at about £2,500,000. A copy of the specifications will be available for examination in the New York office of the Bureau of Foreign and Domestic Commerce, 734 Custom House, until Nov. 7, and in the Chicago office, 76 West Monroe Street, Room 830, from Nov. 9 to 14, inclusive. After this later date it may be obtained on loan from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to E. E. 1003.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEWISTON, ME.—Preliminary plans are being prepared by J. C. and H. H. Stevens, 187 Middle Street, Portland, for a power house for the Central Maine Power Company, Augusta, to cost about $75,000.

BROOKLINE, MASS.—The City Council has authorized the installation of a municipal fire-alarm system, to cost about $150,000, including central station.

HOLYOKE, MASS.—The Holyoke Water Power Company has tentative plans for a hydro-electric plant on the Connecticut River at Holyoke, or at South Hadley Falls on the opposite side of the river. The cost of the initial installation is estimated at $1,000,000.

Middle Atlantic States

ALBANY, N. Y.—Steps have been taken by the North End Improvement Association for the installation of ornamental lamps on the North Pearl Street through to Menands Road.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 17, for six sets of radio transmitting apparatus complete (Schedule 4572).

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 10 for steering engines, electric generating sets, fuel oil blower-burners, thrust bearings and shafts, pressure gages, switchboards and panels, refrigerating machinery, Diesel engine, water coolers, thermometers, pumps, radio transmitters, portable tachometers, air compressor sets, etc., to be delivered to the navy yard and navy supply depot, Brooklyn.

CENTER VILLAGE, N. Y.—The Binghamton Light, Heat & Power Company, Binghamton, has purchased the system of the Afton-Windsor Light, Heat & Power Company, and plans extensions in its transmission lines in this vicinity.

ELMIRA, N. Y.—Plans for the proposed artificial silk mill of the International Rayon Corporation, recently formed with a capital of $2,500,000, to be erected in this section, include a power house.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, Marine Department, until Nov. 11, for two Diesel engine tugboats with electric transmission (Serial Contract No. 28-1925). W. B. Pollock, 6 Beaver Street, is manager.

THENDARA, N. Y.—Plans for the rebuilding of the mill of the Brown's Tract Lumber Company, recently destroyed by fire, with a loss of about $60,000, include a power plant.

PENNSVILLE, N. J.—Plans for the proposed local mill of the Lyons Artificial Silk Company, Sellersville, Pa., to cost about $1,000,000, include a power plant.

SUMMIT, N. J.—The City Council is considering extensions in the street-lighting system on Summit Avenue.

CORAOPOLIS, PA. — Bonds to the amount of $220,000 have been authorized, the proceeds to be used for extensions and improvements to the municipal electric power plant, including the installation of additional equipment.

PHILADELPHIA, PA. — Arrangements have been made to start immediately on the preliminary work for equipping the main line of the Pennsylvania Railroad Company, Southern Division, from Philadelphia to Wilmington, for electrical operation. The first step will be to place all overhead telephone, telegraph and signal wires underground between the two cities.

PITTSBURGH, PA.—The City Council is considering the installation of an electric traffic signal system on Baum Boulevard, Liberty Avenue and on a portion of Pennsylvania Avenue.

PITTSBURGH, PA.—The Crucible Steel Company of America, will install electric power equipment in connection with proposed additions to its Park works, comprising six new mills, to cost about $550,000.

PITTSBURGH, PA. — Application has been made to the Federal Power Commission by the Keystone Power Corporation, 14 Wood Street, for permission to erect 78 miles of transmission line in Elk County, crossing the Allegheny National Forest.

READING, PA.—A petition has been filed with the City Council for the installation of street lamps along Kenhorst Boulevard, from Lancaster Avenue to border of the borough of Wyomissing.

WILMINGTON, DEL. — Plans for the proposed industrial alcohol plant to be erected by the Eastern Alcohol Corporation, a subsidiary of E. I. du Pont de Nemours & Company, to cost about $500,000, include a power house.

ROCKVILLE, MD.—Extensive improvements are contemplated by the Potomac Electric Power Company, Washington, D. C., to its local system, to cost about $100,000. The work will include the substitution of 60-cycle system for the 25-cycle system now in use.

SPENCER, W. VA. — The City Council plans to call a special election to authorize bonds for the installation of an ornamental lighting system in the downtown district.

DANVILLE, VA.—Bids, it is understood, will soon be asked for the installation of a new fire-alarm system in the new fire station, to cost about $10,000.

NORFOLK, VA.—Steps have been taken by the Willoughby Improvement League to secure municipal improvements to the Willoughby section of Norfolk, including an improved street-lighting system.

ROANOKE, VA.—Application has been made to the Federal Power Commission by the Roanoke-Staunton River Power Company for a preliminary permit to develop power on the Roanoke River, east of the city between a point about 6 miles below the city and the mouth of Goose Creek. Tentative locations for four dams have been submitted by the company.

WASHINGTON, D. C.—Extension of the new Sixteenth street-lighting system to cover the entire city has been recommended to the District Commissioners by the Merchants and Manufacturers' Association.

WASHINGTON, D. C.—Bids will be received by the Quartermaster, Marine Corps, Washington, D. C., until Nov. 16, for one set of storage batteries, three switches, one voltmeter, one slate panel (Schedule 249).

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., Oct. 30, 1925. Sealed proposals will be opened in this office at 3 p.m., Nov. 30, 1925, for the mechanical equipment of buildings, and outside services, at the Federal Industrial Institution for Women, for the Department of Justice at Alderson, W. Va. For details see Searchlight Section.

North Central States

BIG RAPIDS, MICH. — The Muskegon River Power & Light Company, Big Rapids, has applied for permission to build a hydro-electric power development on the Muskegon River, to cost about $450,000.

CHEYBOYGAN, MICH.—Plans are being considered to install an ornamental lighting system on Main Street in the business section of the city.

MARQUETTE, MICH.—The City Council has authorized extensions and improvements in the municipal electric plant, to cost about $275,000. New equipment including two Diesel engine driven units, etc., will be installed.

MONROE, MICH.—Plans for the rebuilding of the plant of the Monroe Auto Equipment & Manufacturing Company, recently destroyed by fire with a loss of about $150,000, include a power station.

BEREA, OHIO. — The City Council is considering an issue of $240,000 in bonds for extension and improvements in the municipal electric plant and water works system.

CLEVELAND, OHIO—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 13 for cedar poles for the Division of Light and Power.

CLEVELAND, OHIO—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 13 for furnishing and installing laundry machinery at Warrensville (Ohio) Correction Farm for the Department of Public Health and Welfare.

CLEVELAND, OHIO—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 13 for furnishing and installing complete one 1,000-watt broadcasting station to be located at the new central police station at Payne Avenue and East Nineteenth Street.

BLOOMINGTON, ILL. — Permission has been granted the Illinois Power & Light Corporation, Chicago, to erect a 66,000-volt transmission line from Bloomington to Peoria, a distance of about 40 miles, and to furnish service along the route of the line.

CHICAGO, ILL. — The Public Service Company of Northern Illinois has petitioned the Illinois Commerce Commission for permission to extend its electric distribution system westerly from the village of Manteno, on Bradley Road in Libertyville Township from Volo to a point in Grant Township, a distance of 1¼ miles, in Hanover Township, near Spaulding, and along Arlington Heights Road and Rand Road, Cook County.

DE KALB, ILL.—Plans for the proposed group of buildings to be erected by the Rochelle (Ill.) Canneries on the Lincoln Highway at De Kalb, to cost about $250,000, include a power plant.

FOREST PARK, ILL.—The installation of an ornamental lighting system to cost about $300,000, is under consideration. Suhr, Berryman & Peterson, 105 North Clark Street, Chicago, are engineers.

FREEPORT, ILL.—Plans for the proposed local plant of the W. T. Rawleigh Company, Liberty Street, to cost about $100,000, include a power plant.

JOLIET, ILL.—The Public Service Company of Northern Illinois has been granted permission to erect a 33,000-volt transmission line from Joliet to Streator, a distance of about 55 miles, utilizing part of existing lines between the two cities.

WOOD RIVER, ILL.—The Roxana Petroleum Corporation, Arcade Building, St. Louis, plans to install electric power equipment in connection with extensions and improvements in its local refining plant, to cost about $3,000,000.

BURLINGTON, WIS.—A proposal for the installation of an ornamental lighting system submitted by the Wisconsin Gas & Electric Company, Racine, which furnishes the local electrical service, is under consideration by the City Council.

MANITOWOC, WIS.—The City Council has approved plans of the Public Utilities Commission for extensions to the street-lighting system on several streets.

RACINE, WIS.—Steps have been taken by property owners on College Avenue, Meacha and DeKoven Avenue to secure the installation of ornamental lamps on portions of those thoroughfares.

MABEL, MINN.—The City Council has arranged a bond issue for the installation of an electric light and power system.

SOUTH ST. PAUL, MINN.—The Chicago, Milwaukee & St. Paul Railroad Company, St. Paul, plans to build a power house in connection with its proposed local locomotive and car repair shops, to cost $1,000,000.

ST. JOSEPH, MO.—The St. Joseph Street Railway Company, it is stated, has started work on the erection of a transmission line to and a substation at Lake Contrary, to cost about $300,000. Electric machinery, to cost about $100,000 will be installed.

Southern States

CHARLOTTE, N. C. — Plans are being prepared by the Southern Power Company for a steam-driven electric power plant with initial capacity of 100,000 hp.

LEAKSVILLE, N. C.—Plans for the proposed local furniture factory to be erected by T. L. Gardner, and associates, to cost about $175,000, include a power house.

OAK CITY, N. C.—The installation of an electric distribution system and electric street lamps, etc., is under consideration by the Council.

OTEEN, N. C.—Bids will be received by the United States Veterans' Bureau, Arlington Building, Washington, D. C., until Nov. 17 for refrigerating plant for the local United States Veterans' hospital.

PALMETTO, FLA. — Steps have been taken by the Chamber of Commerce for the installation of a municipal electric power plant in connection with other municipal improvements.

HUNTINGDON, TENN.—The Kentucky-Tennessee Power & Light Company, Bowling Green, plans to erect a transmission line from Gleason to Huntingdon, to supply service here.

SHELBYVILLE, TENN. — The Shelbyville Mills, Inc., plans to install electric power equipment in connection with extensions in its cotton mills, to cost about $200,000.

CAMDEN, ALA. — The Council has granted the Liddell Power Company a franchise to supply electricity here, which, it is understood, will install a local plant.

MONTGOMERY, ALA.—Plans are being prepared by the Independent Ice Company, 115 North Lawrence Street, for a new ice plant on Highland Avenue, to cost about $200,000.

BILOXI, MISS.—Plans are being considered by the City Council for the installation of an ornamental lighting system in the downtown section. W. S. Hawkins, Gulfport, is engineer.

HAZLEHURST, MISS. — The Mississippi Power Company, Jackson, which has acquired the municipal electric plant, plans improvements to the system, to cost about $10,000.

CALICO ROCK, ARK. — John Hammitt and associates are considering plans for the installation of local electric light and power plant. A transmission line is also proposed.

CEDAR GROVE, LA.—The Continental Flat Glass Company, Shreveport, plans to install electric power equipment in connection with the rebuilding of its local plant, recently destroyed by fire with loss of about $250,000.

DE QUINCY, LA.—The Louisiana Public Service Company, New Iberia, which recently acquired the municipal electric plant, is planning extensions in its transmission lines in this section.

TALLULAH, LA. — The City Council plans extensions and improvements in the municipal electric power plant. Henry A. Mentz, Hammond, is engineer.

TISHOMINGO, OKLA. — The Oklahoma Gas & Electric Company, Oklahoma City, which recently acquired the municipal electric plant, plans to build a new 20-ton ice plant here.

BOWIE, TEX.—Plans for the proposed mill of the Bowie Cotton Mills, Inc., recently organized, to cost about $175,000 include a power house.

BROWNWOOD, TEX.—The City Council has authorized the installation of an electric traffic signal system in the business section.

KERRVILLE, TEX.—The Texas Utilities Corporation, Plainview, which has acquired the local plant plans to erect a transmission line in this section.

NEDERLAND, TEX. — The Eastern Texas Electric Company, Beaumont, plans to build a local steam-operated electric power plant.

SAN ANTONIO, TEX.—An agreement has been made between the San Antonio Public Service Company and the Texas Central Power Company providing for the erection of 45 miles of high-tension lines to serve a group of towns in the vicinity of San Antonio. One branch will extend from a station at the outskirts of the city to Pleasanton through Elmdorf, the other will extend to Lytle, where it will connect with the lines of the Texas Central Power Company to serve Devine and the towns south.

WASKOM, TEX.—The East Texas Public Service Company, Marshall, which has acquired the plant of the Waskom Light & Power Company, plans extensions and improvements, including additional transmission lines.

Pacific and Mountain States

BELLINGHAM WASH. — The Bloedel-Donovan Lumber Company plans the electrification of its cargo lumber plant, including a power station equipped with 2,000 kw. turbo-generator and auxiliaries, to cost about $75,000.

CHELAN, WASH.—The Chelan Electric Company has petitioned the Federal Power Commission for permission to develop a power project in Chelan River below the town of Chelan.

TACOMA, WASH.—Petitions have been filed with the City Council for the installation of an ornamental lighting system on Sheridan and Division Avenues to South Eleventh Street.

PORTLAND, ORE.—A petition has been filed with the City Council for the installation of an improved lighting system on Jersey Street from Charleston to Fessenden Street.

ANAHEIM, CAL.—Bids will be received by the City Commission, J. W. Price, city manager, until Nov. 12, for the installation of an ornamental lighting system on North and South Los Angeles Streets, and East and West Center Streets using two lamp steel standards.

EL SEGUNDO, CAL.—The City Council plans to install ornamental lighting system on Grand Avenue, between Main and Concord Streets.

LOS ANGELES, CAL. — Bids will be received by the Municipal Water and Power Commission, 207 South Broadway, until Nov. 17, for electric meters, transformers, instruments, etc. (Specification P-367).

LOS ANGELES, CAL.—The Board of Water and Power Commissioners has applied for water rights on the Colorado River, near Parker, for a proposed hydro-electric development, with initial capacity of 100,000 hp. and ultimately to develop 255,680 hp. E. F. Scattergood is chief electrical engineer.

PASADENA, CAL.—The City Council has approved the installation of an ornamental lighting system on San Pasqual Street, from Lake Avenue to the east city limits, maintained by underground wires.

SAN MARINO, CAL.—The City Council has adopted a resolution providing for the installation of an ornamental lighting system on Euclid Avenue from Mission Street to Monterey Road.

LEWISTON, IDAHO.—An agreement has been made between the Clearwater Timber Company, which plans to build a lumber mill on the Clearwater River at Lewiston, and the Inland Power & Light Company, Portland, Ore., which is planning to build a hydro-electric plant on the Clearwater River, whereby a log pond will be combined with the power development. The proposed power plant will develop about 13,500 hp. The total cost is estimated at between $2,000,000 and $3,000,000.

DENVER, COLO. — Plans for the proposed local pottery of the Abingdon Sanitary Manufacturing Company, Abingdon, Ill., to cost about $375,000, include a power house.

Canada

CHATHAM, ONT. — The erection of a transmission line from Chatham to Kent Bridge, to cost about $40,000 is under consideration by the Hydro-Electric Commission of Ontario, Toronto.

KINGSTON, ONT.—The Public Utilities Commission has decided to begin work on the extension of the ornamental lighting system on Princess Street this fall.

PRESCOTT, ONT.—Plans for the proposed grain elevator (7,000,000 bushels capacity) for the Canada Steamship Lines, include a power plant.

TRENTON, ONT. — Plans for the proposed woolen mill of the Trent River Textiles, Ltd., to cost about $350,000 include a power plant.

LEVIS, QUE.—The Montmagny (Que.) Power Corporation has applied to the Public Service Commission for permission to erect transmission lines to Levis.

Electrical Patents

Announced by U. S. Patent Office

(Issued October 6, 1925)

1,556,534. AUTOMATIC FUSE; J. Manias, Glens Falls, N. Y. App. filed June 27, 1924. Repeating fuse.

(Issued October 13, 1925)

1,556,573. THERMAL RELAY AND CUT-OUT; N. K. Anderson, Wilkinsburg, Pa. App. filed Sept. 1, 1921.

1,556,586. INDUSTRIAL TRUCK; W. C. Carr; Buffalo, N. Y. App. filed Jan. 20, 1923. With load-supporting platforms.

1,556,620. CONTROL SYSTEM FOR ALTERNATING-CURRENT MOTORS; D. L. Lindquist, Hartsdale, N. Y., and J. D. Lewis, Yonkers, N. Y. App. filed Nov. 30, 1923. For a two-speed motor, particularly the starting and reversing thereof.

1,556,626. BURGLAR ALARM; J. J. Pope, Brooklyn, N. Y. App. filed June 7, 1922.

1,556,633. ELECTRICAL CONTROL METHOD; S. Ruben, New York, N. Y. App. filed Sept. 13, 1924. For operating control devices by radio impulses.

1,556,640. CIRCUIT CONTROLLING AND INTERRUPTING APPARATUS; C. E. Silver, Blackwell, Okla. App. filed Feb. 21, 1921. For use in electrically heated machines, to turn on and off the current automatically.

1,556,652. PULL-SWITCH SOCKET; C. E. Warner, Berwyn, Ill. App. filed Sept. 7, 1920.

1,556,673. ELECTRICAL SYSTEM; H. P. Braeutigam, Dayton, Ohio. App. filed May 12, 1919. Engine-generator-battery system for isolated use.

1,556,674. ELECTRICAL APPARATUS; J. G. Campbell, Dayton, Ohio. App. filed Feb. 24, 1923. Centrifugal-switch mechanism for single-phase motor.

1,556,680. COMBINED AIR PURIFIER AND REFLECTOR; F. C. Dorment, Wellington, Ohio. App. filed Sept. 21, 1923. Adapted to be applied to incandescent lamps.

1,556,713. CHANGEABLE EXHIBITOR; M. W. Pullen, Baltimore, Md. App. filed May 12, 1922. Drum switch as used in flashers.

1,556,727. TRAFFIC RECORDER FOR TELEPHONE SYSTEMS; A. B. Smith, Evanston, Ill. App. filed Sept. 1, 1921.

1,556,740. TRANSMISSION OF RADIO SIGNALS EMPLOYING UNDAMPED WAVES; R. B. Woolverton, Washington, D. C. App. filed July 25, 1921.

1,556,743. ELECTRIC SWITCH; C. E. Anderson, Stratford, Conn., and H. U. Badeau, Bridgeport, Conn. App. filed May 14, 1925. For canopy installations.

1,556,750. ELECTRICAL SIGNALING; L. B. Bender, Washington, D. C. App. filed Aug. 29, 1923. System for the transmission and reception of radio signals.

1,556,751. AUTOMATIC TELEPHONE SYSTEM; W. A. Benson, Chicago, Ill. App. filed June 13, 1921.

1,556,761. TRUNK CIRCUITS; H. D. Currier, Chicago, Ill., and G. B. Eaton, Oak Park, Ill. App. filed Feb. 4, 1920. In multi-office exchange systems.

1,556,762. SAFETY DEVICE FOR ELECTRIC IRONS AND THE LIKE; N. A. Curtiss, Ramsey, N. J. App. filed Jan. 22, 1924. To prevent overheating.

1,556,767. WAFFLE IRONS; W. W. Dodge, Jr., Asheville, N. C. App. filed Nov. 24, 1923.

1,556,793. AUTOMATIC TELEPHONE SYSTEM; F. T. Madsen, Green Bay, Wis. App. filed July 3, 1920.

1,556,823. ELECTRIC SWITCH; M. P. Holmes, Claremont, N. H. App. filed Oct. 22, 1917. For use in connection with removable connectors or fuses.

1,556,824. ELECTRIC CONTROLLER; C. W. Wyman, Claremont, N. H. App. filed May 10, 1918. For electrically operated mining machines.

1,556,826. ELECTRICAL CONTROLLER; C. W. Wyman, Claremont, N. H. App. filed July 22, 1918. For alternating-current motors employed in mining and other machines.

1,556,827. FUSE; C. W. Wyman, Claremont, N. H. App. filed May 16, 1919. Heavy capacity, heavy-duty type.

1,556,828. ELECTRICAL CONTROLLING DEVICE; C. W. Wyman, Claremont, N. H. App. filed May 16, 1919. Reversing switch.

1,556,829, 1,556,830. CONTROLLER INTERLOCK; C. W. Wyman, Claremont, N. H. App. filed June 30, 1921.

1,556,831. ELECTRIC CONTROLLING MEANS; C. W. Wyman, Claremont, N. H. App. filed Nov. 23, 1921. For use in connection with mining machines.

1,556,838. STORAGE-BATTERY INDICATOR; G. A. Jensen, Denver, Col. App. filed May 3, 1924. Fluid-level indicators.

1,556,842. TELEPHONE SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Sept. 19, 1921. Multiple-line-lamp system.

1,556,858. SHIELDED HOIST CONTROLLER; H. H. Logan, Chicago, Ill. App. filed May 16, 1924.

1,556,904, 1,556,905, 1,556,906. AUTOMATIC CALLING DEVICE; J. G. Blessing, Oak Forest, Ill. App. filed Aug. 22, 1921. Impulse-sending device of the dial type.

1,556,917. ELECTRICAL APPARATUS; W. C. Dee, Cleveland, Ohio. App. filed Sept. 19, 1918. For the use of X-rays in dental and other work.

1,556,930. ELECTRICAL HEATER; Hans Grau, Zurich, Switzerland. App. filed July 15, 1924. Method of making an element.

1,556,942. SWITCHING MECHANISM; F. A. Lundquist and J. A. Kropp, Chicago, Ill. App. filed April 25, 1921. For automatic telephone exchange.

1,556,948. MEASURED-SERVICE TELEPHONE SYSTEM; F. T. Madsen, Maywood, Ill. App. filed May 5, 1923.

1,556,974. IMPULSE TRANSMITTER OF THE DIAL TYPE; E. Tanke, Falkenhagen, Germany. App. filed Nov. 29, 1921. For telephone systems.

1,556,987. AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEM; D. A. Christian, London, England. App. filed Sept. 7, 1923.

1,556,990. COMMUTATOR BRUSH; R. L. Henry, Brooklyn, N. Y. App. filed Oct. 12, 1922. Having a path of least electrical resistance along predetermined lines and directions and comparatively high resistance in directions perpendicular to the predetermined path of least resistance.

1,556,999. AUTOMATIC TELEPHONE EXCHANGE; A. E. Keith, J. Erickson and C. J. Erickson, Chicago, Ill. App. filed June 18, 1902.

1,557,000. DYNAMO FRAME; E. R. Kuhle, Dayton, Ohio. App. filed Nov. 18, 1924.

1,557,001. SWITCH MECHANISM; H. K. Ansingh, Toronto, Ontario, Canada. App. filed Feb. 20, 1923. Current-distributing panels used for controlling the control circuits of the truck-type circuit breakers.

1,557,003. ELECTRIC SWITCH; W. M. Austin, Swissvale, Pa. App. filed Nov. 2, 1920. Of the double-throw plunger type for use in connection with circuit breakers, to control auxiliary circuits.

1,557,004. APPARATUS OR MACHINE FOR MAKING AND COOKING WAFER BISCUITS, CUP WAFERS, CORNETS AND THE LIKE; T. O. Bates, Liverpool, England. App. filed Dec. 9, 1924.

1,557,006. SWITCH BOX; H. G. Baxter, Baldwin, N. Y. App. filed Oct. 9, 1920. Inclosed switch of the safety type.

1,557,009. 1,557,010. ELECTRIC WAFFLE IRON; H. M. Biebel, Oakmont, Pa. App. filed July 27, 1922.

1,557,017. SIGNALING SYSTEM; Q. A. Brackett, Springfield, Mass. App. filed Sept. 2, 1921. Control of high-frequency oscillations of an arc oscillator.

1,557,018. SHORT-CIRCUITING DEVICE; J. L. Brown, Verona, Pa. App. filed Oct. 15, 1923. Centrifugally operated mechanism for use with single-phase machines.

1,557,024. DISCONNECTING SWITCH LATCH; L. B. Chubbuck, Hamilton, Ontario, Canada. App. filed July 15, 1920.

1,557,026. ELECTRIC RIVET HEATER; O. A. Colby, Irwin, Pa. App. filed Sept. 17, 1920.

1,557,029. PLUG-TRIPPING DEVICE; O. A. Colby, Irwin, Pa. App. filed Dec. 13, 1923. For appliances.

1,557,036. TERMINAL NETWORK FOR HIGH-PASS WAVE FILTERS; H. W. Elsasser, New York, N. Y. App. filed March 24, 1921.

1,557,037. REDUCTION OF CROSS-TALK; L. Espenschied, Hollis, N. Y. App. filed Dec. 11, 1922. In multiplex-transmission systems.

1,557,038. POWER-FACTOR METER; R. D. Evans, Pittsburgh, Pa. App. filed June 9, 1920.

1,557,048. VIBRATION APPARATUS, PARTICULARLY FOR RECEIVING AND PRODUCING SOUND WAVES; W. Hahnemann, Kitzeberg, near Kiel, Germany. App. filed Feb. 4, 1921.

1,557,052. SHORT-CIRCUITING DEVICE; W. H. Himes, Pittsburgh, Pa. App. filed May 11, 1921. Centrifugally operated; for single-phase machines.

1,557,056. STARTING SAFETY SWITCH; O. S. Jennings, Brooklyn, N. Y. App. filed April 7, 1920.

1,557,057. SAFETY SWITCH; O. S. Jennings, Brooklyn, N. Y. App. filed Sept. 8, 1920.

1,557,062. ELECTRIC FURNACE; A. D. Kenne, Pittsburgh, Pa. App. filed Aug. 18, 1923. Arc furnace.

1,557,065. MOTOR-CONTROL SYSTEM; G. E. King, Wilkinsburg, Pa. App. filed Feb. 8, 1923. As employed in connection with machine tools.

1,557,067. COMBINED TRANSMITTING AND RECEIVING ARRANGEMENT; L. Kuhn, Berlin-Charlottenburg, Germany. App. filed Aug. 26, 1921.

1,557,073. CONTROL APPARATUS; J. S. McWhirter, New York, N. Y. App. filed June 9, 1919. Platform controller for electric railway motor.

1,557,074. ELECTRIC RIVET FURNACE; A. M. McFarland, Wilkinsburg, Pa. App. filed Aug. 3, 1921.

1,557,079. TELEPHONE SIGNALING EQUIPMENT; L. F. Morehouse, Montclair, N. J. App. filed Sept. 16, 1919.

1,557,080. SHORT-CIRCUITING DEVICE; H. D. Murdock, Wilkinsburg, Pa. App. filed May 19, 1922.

1,557,088. CHANGE-OVER SWITCH; E. K. Read, Wilkinsburg, Pa. App. filed Sept. 24, 1920. For transferring the load circuit from one supply circuit to another in the event of a reduction in voltage in one of the circuits.

1,557,094. INSULATOR CONNECTOR; E. E. Rose, Swissvale, Pa. App. filed Sept. 13, 1919. For connecting series-related insulator sets.

1,557,101. SOUND-WAVE TRANSLATING DEVICE; J. Slepian, Swissvale, Pa. App. filed Oct. 28, 1922.

1,557,104. RESISTOR MOUNTING FOR ELECTRIC FURNACES; F. Thornton, Jr., Pittsburgh, Pa. App. filed Aug. 18, 1923.

1,557,105. CONNECTING-PLUG REMOVER; F. Thornton, Jr., Pittsburgh, Pa. App. filed Nov. 12, 1923.

1,557,110. ARRANGEMENT FOR THE PROTECTION OF SUBSTATIONS; P. K. van der Sterr, Frankfort-on-the-Main, Germany. App. filed Aug. 29, 1921. System having a number of circuit interrupters controlled by a common voltage-drop or reverse-energy relay.

1,557,124. ALTERNATING-CURRENT MOTOR; Hans Weichsel, St. Louis, Mo. App. filed Oct. 20, 1924. Self-excited synchronous induction motor.

1,557,128. CIRCUIT-INTERRUPTING SYSTEM; G. P. Wilson, Wilkinsburg, Pa. App. filed Jan. 31, 1921. Employed for the protection of rolling-mill motors.

1,557,142. ELECTRICALLY HEATED MELTING POT; G. O. Cromwell, Chicago, Ill. App. filed April 24, 1920.

1,557,155. TELEGRAPH INSTRUMENT; J. J. Ghegan, East Orange, N. J. App. filed Feb. 11, 1924. Adapted for general receiving and transmitting purposes.

1,557,158. ELECTRIC MOTOR; H. C. Grant, Bayonne, N. J. App. filed May 3, 1922. For operating a signal horn.

1,557,194. ELECTRICAL APPARATUS; J. G. Campbell, Dayton, Ohio. App. filed March 27, 1924. Short-circuiting device for the commutator of a repulsion-induction motor.

1,557,202. GENERATOR BRUSH; J. H. Hunt, Dayton, Ohio. App. filed Oct. 3, 1923. Composition brush having an integral bracket adapted to be attached to a machine in any suitable manner.

1,557,205. AUTOMATIC SWITCH; C. F. Kettering, Dayton, Ohio. App. filed Oct. 21, 1919. For an ampere-hour meter.

1,557,213. ELECTRICAL APPARATUS; R. L. Lee, Dayton, Ohio. App. filed Feb. 25, 1924. Constant-speed motor regardless of variations in load or voltage.

1,557,221. ELECTRICAL APPARATUS; C. Van Rennes, Dayton, Ohio. App. filed Nov. 24, 1923. Mechanism for reversing electric-motor housed within the motor frame.

1,557,229, 1,557,230. TERMINATING NETWORK FOR FILTERS; O. J. Zobel, Maplewood, N. J. App. filed April 30, 1920. Selective circuits of the type known as wave filters.

1,557,247. COMBINED TELEGRAPH RELAY AND TELEPHONE; W. R. Garner, Erie, Pa. App. filed Jan. 20, 1920.

1,557,283. TRANSFORMER STRUCTURE; S. Horelick, Pittsburgh, Pa. App. filed May 4, 1923. Tank for oil-cooled transformers.

1,557,353. SWITCH; H. J. Frank, Detroit, Mich. App. filed May 5, 1922. Toggle type.

1,557,373. BURGLAR ALARM; A. D. Sindt, New York, N. Y. App. filed March 30, 1922.

1,557,394. ELECTRIC SWITCH; C. E. Anderson, Stratford, Conn. App. filed March 11, 1921. Toggle type.

1,557,404, 1,557,405. SIGNALING SYSTEM; C. E. Beach, Binghamton, N. Y. App. filed Jan. 7, 1920. For fire-alarm use.

1,557,420. SIGNALING SYSTEM; A. A. Clokey, Rutherford, N. J. App. filed June 18, 1920. Relay adapted for use as a transmitting relay for submarine-cable signaling and the like.

1,557,430. ELECTRICAL DISPLAY APPLIANCE; L. R. Crow, Vincennes, Ind. App. filed March 9, 1922.

Financial and Corporate

Utility Stocks Gain

Electric Refrigerating Shares Turn More Active—National Power Splits Fifteen to One

AT NO time in history have the New York Stock Exchange and the New York Curb Market carried so wide a list of issues as they now offer, and, it may be added, few bull markets of the past have persisted as has the present. A combination of good business and cheap money unquestionably has enabled strong speculative operators to hold prices up, but sight should not be lost of the fact that the country for the first time since the war enjoys a sound business situation.

More than most persons had anticipated, power and light stocks have maintained their large gains, but buyers fortunately now are exercising greater discrimination than formerly in their selections of utility issues. More and more attention seems to be paid to the electric machine stocks, Servel, in jumping to 35, having made the largest gain of the week in that group. Kelvinator and Nizer both have been strong. General Electric, to name another issue outside of the power and light operating list, improved its position by eight points during the week.

Among the power and light company issues particular attention on the big board was given to North American Company's shares, which, for reasons explained elsewhere in this issue, rose to a new high at 75. On the curb Southeastern Power & Light Company's shares, after selling at 28 and a fraction, rose to 34½ on heavy buying and Commonwealth Power common moved several points higher on improved earnings and greater interest in the market for that issue. Northern Ohio Power was the subject of speculative manipulation and rose to 19, but fell back to 14 and a fraction after the manipulators had finished their fireworks.

At a meeting of the board of directors of the National Power & Light Company it was decided to split the common stock selling on Wednesday at 439 on a basis of fifteen to one.

New Capital Issues

During the first week of November electric light and power public utility companies were active in making new offerings to the investing public. The largest bond issue consisted of $2,825,000 Interstate Public Service Company first mortgage and refunding 5½ per cent bonds priced at 97¼ to yield over 5.70 per cent. Part of the proceeds will be used in financing the acquisition of the Indiana Power Company.

The Madison Gas & Electric Company floated an issue of general and refunding mortgage 5 per cent gold bonds, dated November 1, 1925, and maturing November 1, 1950, to the amount of $2,200,000. Funds obtained from the sale of these bonds will be used to retire maturing bonds, to reimburse the company for capital expenditures made and to provide funds for the completion of extensions and additions. A new issue of $1,500,000 Gulf Public Service Company first mortgage twenty-year sinking-fund 6 per cent gold bonds was offered at 97½ and interest to yield 6.22 per cent.

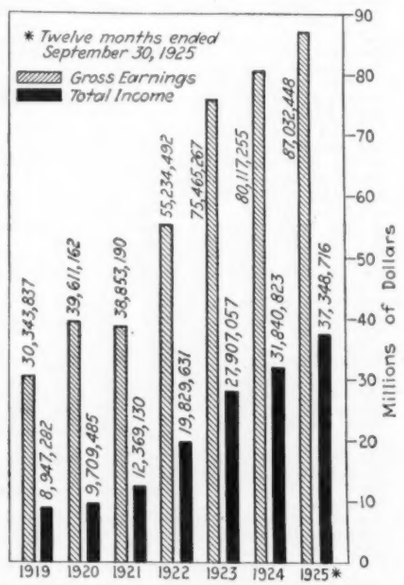
Eastern States Power Corporation, organized last month for the purpose of acquiring and holding securities of public utility companies, issued 40,000 shares of preferred stock, series A, with common-stock warrants, the price being $97.50 per share and accrued dividend to yield over 7.15 per cent. There are to be issued 120,000 warrants entitling the holders to subscribe to a like number of shares of class B common stock.

World's Largest Electric Producer

North American Company's New Acquisitions Also Will Swell Its Annual Gross Revenue from $87,000,000 to Well Over $100,000,000

BY PAUL WILLARD GARRETT

NO STOCK of a public utility listed on the New York Stock Exchange has attracted more attention recently than that of the North American Company in its rise from a 1925 low of 41 to a new record high level of 75. That the shares even at the present quotation possess an intrinsic value greatly in excess of what is offered by numerous issues that have made spectacular gains becomes apparent after an examination of the earnings statement published this week and after a consideration of new acquisitions not yet reflected in the parent's compilation of earnings.



GROSS EARNINGS OF THE NORTH AMERICAN COMPANY AND SUBSIDIARY COMPANIES

In the twelve months ended September 30, 1925, North American's gross revenues mounted to a new high for all time of $87,032,448, which, incidentally, is a 10.85 per cent increase over the same period a year ago. Net income, on the other hand, reached $37,348,716, which was a 23.28 per cent increase over the same period a year ago. In other words, with a 10.85 per cent gain in gross revenues this year to date, the company shows a 23.28 per cent increase in net income.

In view of the continued rise in the company's common stock, it is interesting to analyze the company's consolidated income statement to determine what was earned on the shares. From $87,032,448 of gross revenues must be deducted $53,405,856 for operating expenses and taxes, making the net income from operations $33,626,591. Other net income swelled the total net income to $37,348,716. Fixed charges of subsidiaries, preferred dividends of subsidiaries and minority interest charges absorbed $15,892,236, leaving a balance available for depreciation reserves, dividends and surplus of $21,456,479. Before payment either of preferred or common dividends North American Company deducts a certain amount on account of depreciation and in the twelve months ended September 30, 1925, deducted for that purpose $8,765,673, leaving a balance available for dividends and surplus of $12,690,806. Of that sum preferred dividend requirements took only $1,744,968. The balance available for depreciation reserves and dividends on the common stock amounted to $6.26, or 62.61 per cent a share on common stock outstanding September 30, 1925. The balance, after depreciation and all other reserves and preferred stock dividends, amounted to $10,945,838, or $3.48 a share, which is 34.77 per cent on common stock outstanding.

While the North American Company's principal subsidiaries are the Cleveland Electric Illuminating Company, the Milwaukee Electric Railway & Light Company and the Union Electric Light & Power Company, doing the business respectively in the three industrial cities of Cleveland, Milwaukee and St. Louis, other acquisitions of great importance have been made this year. The most recent of these in-

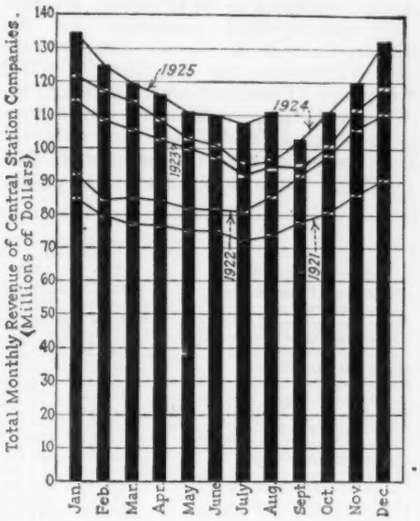
volved the acquisition of control both of the Western Power Corporation, which gives the North American a vast field for hydro-electric development in California, and the Mississippi River Power Company, formerly controlled by Stone & Webster, Inc. Since North American now is showing a gross revenue at the annual rate of $87,000,000 and the Western Power system alone in the twelve months ended September 30, 1925, showed $17,000,000, it is evident that North American's gross will be materially in excess of $100,000,000 once the new earnings have been fully reflected in the parent company's statement.

With the inclusion of the Western Power properties and the Mississippi River power system, the North American group becomes the largest in the world producing electrical energy under a single ownership. Electrical output of the present system in the twelve months under review amounted to 2,618,513,603 kw.-hr., or nearly 16 per cent more than in the year before.

Allis-Chalmers Quarterly Statement

The earnings statement of the Allis-Chalmers Manufacturing Company for the third quarter of 1925 shows net profit of $826,107 as compared with $824,562 for the same period of 1924 and billing amounting to $7,298,571 against $6,926,329 for the third quarter of last year. The net profits reported are after full provision for federal income taxes. Unfilled orders on hand as of September 30, 1925, aggregate $10,143,743 and compare with $9,668,731 at the close of the second quarter in 1925, an increase of $475,012 or 4.9 per cent. Deducting $288,702 for quarterly dividend on preferred stock from the earnings of $826,107 leaves a balance of $537,404 available for the common, which is equivalent to $2.09 per share, compared with $2.08 per share in the third quarter of 1924.

Total Revenue for First Eight Months Is $937,276,000



GROSS REVENUE TOTALED $111,500,000 DURING THE MONTH OF AUGUST

Reports received by the ELECTRICAL WORLD from central-station systems reporting 77 per cent of the total generator rating of the industry indicate that the total gross revenue from the sale of energy during the month of August was $111,500,000, an increase of $16,100,000, or 16.9 per cent over August of last year. The operating and maintenance expenses totaled $53,000,000 during August.

Servel Officers Elected to Wheeler Board.—Following the transfer of all the common stock of the Wheeler Condenser & Engineering Company to the Servel Corporation, Hamilton G. Scott, chairman of the board, and Paul Plunkett, treasurer of the Servel Corporation, were elected directors of the Wheeler organization.

Radio Corporation Reports Deficit.—Gross income of the Radio Corporation of America from sales, communications and other income for the quarter ended September 30 amounted to $7,351,142 as against $11,183,379 for the same period of 1924. The statement showed a deficit of $358,275 after expenses, taxes, depreciation, accrued reserves, etc., which compares with a net profit of $1,200,284 in the third quarter of 1924. For the nine months ended September 30 the corporation reported surplus profits of $1,179,001, equivalent to 12 cents a share on the 1,155,400 no-par-value common shares.

New Electric Light and Power Financing Active in October

PUBLIC offering of new issues of stocks, bonds and notes by electric service companies during the month of October amounted to $73,232,500, a figure which marks a decided recovery after the falling off in the two previous months from $70,488,510 in July to $47,525,000 in August and $41,985,000 in September. Exclusive of local sales to customers and employees, the light and power companies have raised $842,274,510 during the first ten months of the year, as against $791,369,700 for the same period of 1924.

Out of a total of thirteen bond and note issues eleven were long-term issues. The largest individual loan was floated by the North American Edison Company in the form of preferred stock to the amount of $19,400,000. The average yield declined sharply to 6.00 per cent from 6.63 per cent in September. Attention is called to the prominent part taken by refunding operations.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN OCTOBER

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
American Public Service Co.	$2,000,000	17	First lien gold bonds, series B		5½	96	5.88
Southern Canada Power Co., Ltd.	6,000,000	30	First mortgage bonds, series A	To retire bonds and finance additions now being made	5	97	5.20
United Electric Light Co. (Wilmerding, Pa.)	500,000	20	First mortgage gold bonds, series A	Construction	6	99	6.08
Alabama Power Co.	5,000,000	27	First mortgage lien and refunding gold bonds	Construction	5	95½	5.30
West Kentucky Electric Power Co.	1,000,000	30	First mortgage gold bonds, series A	To retire existing debt	5½	92½	6.05
New England Public Service Co.	3,860,000	..	Preferred stock ($7 dividend series)	To acquire stocks of subsidiaries and for other corporate purposes	7	96½	7.25
Missouri Power & Light Co.	6,500,000	30	First mortgage gold bonds, series A	Extensions	5½	98½	5.60
Penn Central Light & Power Corp.	5,500,000	50	First and refunding mortgage gold bonds		5½	97	5.65
North American Edison Co.	19,400,000	..	Preferred stock	For advances to and investments in securities of subsidiaries, retirement of floating debt, investments in other properties or other corporate purposes	6	97	6.18
National Electric Power Co.	1,722,500	..	Participating stock, class A	Additions	..	26½	....
	2,000,000	20	Secured gold bonds		6	97	6.25
	1,000,000	..	Cumulative preferred stock		7	95	7.36
Columbus (Ohio) Ry., Power & Light Co.	2,500,000	..	First preferred stock	To retire floating debt in part and for construction	6	100	6
Interstate Utilities Corp. (Del.)	500,000	3	Convertible gold notes	To finance acquisitions, additions and improvements	6½	99½	7.70 to 8.00
Trenton Gas & Electric Co.	450,000	10	Sinking fund gold debentures	To reimburse for retiring debt and to provide funds for additions and improvements	6½	96½	7
Great Western Power Co.	4,000,000	5	Gold notes	Refunding	5½	99	5.70
Central States Electric Corp.	10,000,000	20	Debentures	Refunding and corporate purposes	6	98½	6.12
Community Power & Light Co.	750,000	..	Cumulative first preferred stock	To finance acquisition of new properties and for extensions made and to be made	7	97	7.20
	250,000	..	Cumulative participating preferred stock		8	100	8
Western States Utilities Co.	300,000	20	First mtge. sinking fund gold bonds, series A		6	96¾	6.30
Total	$73,232,500						

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power and electric manufacturing companies:

Name of Company	Per Cent	When Payable
Brooklyn Edison	2	Dec. 1
Consolidated Gas of New York, com	$1.25	Dec. 15
Houghton County Electric Light, com	.25	Nov. 2
Houghton County Electric Light, pf	.75	Nov. 2
Ingersoll-Rand, com	$2	Dec. 1
Kelvinator Corp	.50	Nov. 20
Kelvinator Corp., stock dividend	1½	Nov. 20
Pacific Lighting, com	2½	Nov. 15
Pacific Lighting, pf	1¾	Nov. 15
Southern Canada Pwr	$1	Nov. 16
White (J. G.) & Co., Inc., pf	1¾	Dec. 1
White (J. G.) Management, pf	1¾	Dec. 1
White (J. G.) Engineering, pf	1¾	Dec. 1

New Foreign Loans.—A new foreign issue has been floated in this country in the form of first mortgage 5 per cent sinking fund gold bonds, series A, of the Sauda Falls Company, Ltd., totaling $4,000,000. The bonds are priced at 98 and interest to yield over 5¼ per cent. The Sauda Falls Company, a subsidiary of the Union Carbide & Carbon Corporation, was organized in 1913 to develop the water-power resources of Storelven (Great River) Norway, for which it holds concessions from the Norwegian government extending to 1979. These 5 per cent bonds are guaranteed unconditionally by indorsement as to principal, interest and sinking-fund payments by the Union Carbide & Carbon Corporation. On Wednesday the Hamburg Electric Company (Hamburgische Elektricitäts-Werke, Aktiengesellschaft) issued ten-year sinking fund 7 per cent external gold debentures to the amount of $4,000,000. These debentures were priced at 95½ and interest to yield over 7.65 per cent. The company, founded in 1894, does the entire electric light and power business in the Free State of Hamburg and adjacent territory.

Company Reports

The following statements of earnings have been issued by electric light and power companies for September:

Name of Company	Gross Earnings for September 1925	1924
Adirondack Power & Light	$698,926	$627,386
Alabama Power	1,164,540	752,973
American Power & Light	4,290,087	3,556,784
American Water Works & Elec.	3,371,735	3,063,216
Asheville Power & Light*	104,238	105,498
Bangor Hydro-Electric	137,806	127,534
Barcelona Trac., Light & Power	6,965,437	6,132,551
Binghamton Light, Heat & Pwr.	139,994	117,558
Brazilian Trac., Light & Power	2,846,091	2,248,260
Carolina Power & Light*	257,758	196,604
Central Illinois Light	327,701	278,937
Central Maine Power	338,959	320,705
Cities Service	1,231,068	1,054,200
Commonwealth Power	3,566,096	3,087,101
Community Power & Light	345,537	277,882
Consumers Power	1,697,044	1,445,442
Cumberland City Power & Light	332,614	317,807
Electric Power & Light	3,624,324	3,226,432
Florida Public Service	93,991	59,829
Fort Worth Power & Light*	224,546	238,898
Idaho Power*	255,061	259,155
Kansas Gas & Electric*	334,678	380,192
Metropolitan Edison	716,180	646,974
Nebraska Power*	315,580	308,246
Nevada California Electric	362,110	343,537
New Bedford Gas & Edison Lt.	310,144	281,625
New England Co. Power System*	621,527	514,913
New Jersey Power & Light	116,560	85,451
Newport News & Hampton Ry. Gas & Electric	181,950	171,570
North Carolina Pub. Service	147,627	151,597
Northern Ohio Power	921,787	826,630
Ohio Edison	113,584	107,058
Pacific Power & Light*	298,138	264,967
Penn Central Light & Power	347,412	294,880
Penn Edison	249,823	241,280
Philadelphia Co	4,436,444	4,227,877
Portland Electric Power	876,338	859,472
Republic Railway & Light	873,515	825,621
Sayre Electric	22,703	18,462
Southern California Edison	2,250,446	1,743,242
Southern Indiana Gas & Electric	210,010	205,612
Southwestern Power & Light	1,115,932	1,017,326
Tennessee Electric Power	934,570	766,992
Texas Power & Light*	520,765	462,907
United Gas & Electric	1,117,401	1,026,570
Washington Water Power	513,964	436,640
West Penn Co	2,042,442	1,950,928
Winnipeg Electric	409,185	393,871
Yadkin River Power*	140,835	149,501

*August.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Oct. 31	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	72	62	75½
Adirondack Pwr. & Lt.—7% pf.	100½	98	106
Adirondack Pwr. & Lt.—8% pf.	105	103	115
Adirondack Pwr. & Lt., com.—50.	75	31	98
Ala. Pwr., pf.	103	97½	103
Allis-Chalmers Mfg. pf.	f 108¾	103½	108¾
Allis-Chalmers Mfg., com	f 89¼	71½	95
Amer. & Foreign Pwr., pf. 25% pd.	132	133	142
Amer. & Foreign Pwr., 7% pf.	93	87	94
Amer. & Foreign Pwr., com	f 45½	27½	51¾
Amer Bosch Magneto, com.—no par	f 35	26¾	54¼
Amer. Brown, Boveri, ptc., stk	f 50	50	53¾
Amer. Elec. Pwr., pf.	c 103¾	9¼	104¼
Amer. Gas & Elec., 6% pf.—no par	91¾	85	91
Amer. Gas & Elec., com.—no par	78	70	85
Amer. Lt. & Trac., 6% pf.	107	93	109
Amer. Lt. & Trac., com	266	139	274
Amer. Pwr. & Lt., 6% pf.	94	84	95
Amer. Pwr. & Lt., com.—no par	57	52	67
Amer. Pub. Serv., 7% pf.	90	88	94
Amer. Pub. Serv., com	47	45	90
Amer. Pub. Utilities, 4% pf.	79	....	....
Amer. Pub. Utilities, 6% pf.	77	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com	78	70	103
Amer. Superpwr., pf.—25	f 26¼	24¼	27¼
Amer. Superpwr., Class A—no par	f 36¼	....	....
Amer. Superpwr., Class B—no par	f 39¼	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	99¾	97½	103
Amer. Wtr. Wks. & Elec., com	f 56¾	34¾	68¾
Appalachian Pwr., 7% pf.	101	92	100
Appalachian Pwr., 1st pf., 7%	101	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	79	75	87
Arizona Pwr., com	23	15	34¼
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	97	92	102
Arkansas Lt. & Pwr., com	100	65	101
Asheville Pwr. & Lt., 7% pf.	k101	98	102½
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	f 85	....	....
Assoc. Gas & Elec., Class A	f 37¼	....	....
Babcock & Wilcox, com	f148	....	....
Birmingham Elec. pf.—$7—no par.	100½	98	101½
Blackstone Valley Gas & Elec., com.—50	88	....	....
Brazilian Trac., Lt. & Pwr., com.	f 78	....	....
Broad River Pwr., pf.	94	90	97
Brooklyn Edison, com	f153	120¾	153
Buffalo Gen. Elec., com.—no par	58	50	77
Buffalo, Niagara & East. Pwr., pf.—25	k23½	....	....
Buffalo, Niagara & Eastern Pwr., com.	£33	....	....
Carolina Pwr. & Lt., pf.—$7—no par	104	100	107
Carolina Pwr. & Lt., com	400	290	445
Central Ariz. Lt. & Pwr., pf.	100	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	87	84	93
Central Ind. Pwr., 7% pf.	88	88	95
Central Pwr. & Lt., pf.	92½	88	95
Central States Elec., 7% pf.	94	87	98
Central States Elec., com	220	70	200
Chicago Fuse Mfg., com., no par	a32	27½	39½
Cincinnati Gas & Elec., com	g89¾	82	90
Cities Service, 6% pf.	83	80	84
Cities Service, pf. B—10	f 7¾	....	....
Cities Service, pf. BB—100	f 78	....	....
Cities Service, com	38	34	43
Cities Service, Bks. Shrs.	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	f112¾	104¼	113¾
Columbia Gas & Elec., com.—no par	f 83¾	45¾	86
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	f100	....	....
Columbus Elec. & Pwr., com	f136	....	....
Columbus Ry., Pwr. & Lt., pf. A	97	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr., & Lt., com	150	114	150
Commonwealth Edison, com	a138	130½	141¾
Commonwealth Pwr., 6% pf.	82½	80	85½
Commonwealth Pwr., com—no par	35	30½	43¾
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	111	105	110
Cons. Gas of N. Y., pf.	f 58¾	....	....
Cons. Gas of N. Y., com—no par	f 94¾	74½	95½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	c103¾	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	c 109¼	108	112
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	109	108	112
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	c 125	122	127¾
Cons. Gas, Elec. Lt. & Pwr. of Balti., com.—no par	44	32	45
Cons. Utilities of Dela., 7% pf.	f 85	80	84
Consumers Pwr., 6% pf.	94¾	90	97
Consumers Pwr., 6 6% pf.	101	97	102
Continental Gas & Elec., 7% ptc. pf	94¾	85	97
Continental Gas & Elec., 7% pr. pf.	94	89	95
Continental Gas & Elec., com	140	77	145
Crocker Wheeler, com	15	21	28
Crocker Wheeler, pf.	..	65	80
Dallas Pwr. & Lt., 7% pf.	103	100	102½
Dayton Pwr. & Lt., 6% pf.	95½	88	100
Dayton Pwr. & Lt., com	420	180	460
Detroit Edison, com	f147¼	110	159¾
Dubilier Condenser & Radio, com	f 14¾	....	....
Dubuque Elec., 7% pf.	90	80	90
Duquesne Lt., 7% pf.	111	104	112
East. Tex. Elec., 6% pf.	100	100	105
East. Tex. Elec., com	30	70	75½
Edison Elec. Illum. of Boston, com.	d209½	200	213
El Paso Elec., com.	f 74	....	....
El Paso Elec., pf.	f100	....	....
Elec. Bond & Share, 6% pf.	k103¾	101¼	106¼
Elec. Bond & Share Sec., com.—no par	k 68¾	56¾	80¾
Elec. Investors, 6% pf.	92	95	96
Elec. Investors, com	61¼	30	66¼
Elec. Investors, 10% pd. receipts	44	15	48¾
Elec. Pwr. & Lt., ctfs. pf.	f 92	89¾	94
Elec. Pwr. & Lt., ctfs., 40% pd.	f107	100	110
Elec. Pwr. & Lt., ctfs. full pd.	f108	100½	110½
Elec. Pwr. & Lt., ctfs., com	f 32¼	17¼	40¼
Elec. Storage Battery, com.—no par	f 71¼	60¼	71¾
Elmira Wtr., Lt. & R.R., 7% pf.	96	93	98
Emerson Elec., pf.	b101	95	101
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.	99	100	103
Engr. Pub. Serv., com.—no par	24¼	22½	30
Eureka Vacuum Cleaner, com.—no par	f 52¾	51¼	55¾
Fairbanks Morse, com	f 51¾	32½	54¾
Federal Lt. & Trac., com	f 29	26	36
Federal Light & Traction, pf.	f 82¾	82¼	86¼
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	k106	99½	107½
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	17	32	40
Gen. Elec., com	f321¼	227½	337½
Gen. Elec., special—10	f 11¾	10¼	11¾
Gen. Gas & Elec., 6% pf.	220	72	240
Gen. Gas & Elec., 7% pf.	165	120	175
Gen. Gas & Elec., com	210	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	130	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par	140	104½	180
Gen. Gas & Elec. (Del.) com. A no par	60	42	64¼
Gen. Gas & Elec. (Del.) com. B no par	56	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par	95	97½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par	106	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par	94	88	96
Ga. Lt., Pwr., & Rys., 6% pf.	78	74	85
Ga. Lt., Pwr. & Rys., com	60	25	74
Ga. Ry. & Elec. .5% pf.	j 83	78¼	84¼
Ga. Ry. & Elec. com	j124¼	115¼	115¼
Ga. Ry. & Pwr., 8% pf.	f112	....	....
Ga. Ry. & Pwr., 7% pf.	f101¼	....	....
Ga. Ry. & Pwr. 4% pf.	108	62	110
Ga. Ry. & Pwr., com	111	62	118
Gt. Western Pwr., 7% pf.	h 101½	....	....
Havana Elec. Ry., Lt. & Pwr., com.	f236	112	246
Havana Elec. Ry., Lt. & Pwr., pf.	j116	115	116
Hurley Machine, com.—no par	a 48¾	41¼	56
Idaho Pwr., 7% pf.	100½	97½	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	97	92½	98
Int. Combustion Engr., com.—no par	f 49¾	31½	51
Int. Utilities, class A—no par	36	33½	36
Int. Utilities, class B—no par	f 9¼	....	....
Interstate Pwr., pf., $7, no par	90	90	95
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	95	90	96

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal. gCincinnati; hSan Francisco. tBid, low, high, Monday, Nov. 2. jLatest quotations available. kBid, low, high, Wednesday, Nov. 4.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Oct. 31	Low 1925	High 1925
STOCKS—Continued			
Jersey Central Pwr. & Lt., com.	45	15	50
Johns-Manville, com.—no par	f165	....	....
Kansas Gas & Elec., 7% pf.	k100½	97½	102
Kelvinator Corp., com.—no par	f 76	....	....
Kentucky Hydro-Elec., com.	a 91½	85½	92½
Kentucky Sec., 6% pf.	73	67	78
Kentucky Sec., com.	82	77	87
Kentucky Utilities, 6% pf.	89	82	95
Kings County Ltg., 7% pf.	f100	....	....
Laclede Gas Lt., com.	f 168	110½	178
Lehigh Pwr. Sec., com.—no par	168	82	174
Long Island Ltg., 7% pf.	104½	100	105
Long Island Ltg., com—no par	130	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par	37½	28½	49½
Maytag Mfg., com.	f 25	23½	26½
Memphis Pwr. & Lt., pf., $7, no par	102	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	96
Metropolitan Edison, pf., $7, no par	104	100	110
Middle West Utilities, 7% pf.	c97	91½	98½
Middle West Utilities, 7% pr. lien pf.	a106	98	107½
Middle West Utilities, com.—no par	a115	92½	125
Midland Utilities, pr. ln. pf.	a 99½	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	87	83½	87
Minn. Pwr. & Lt., 7% pf.	k101	97½	102
Miss. Pwr. & Lt., pf.	f100	....	....
Miss. River Pwr., 6% pf.	94	87½	94
Miss. River Pwr., com.	117	37	124½
Montana Pwr., com.	f 85½	64	99½
Montreal Pwr., com.	f213½	....	....
Mountain States Pwr., pf.	f 93	....	....
Mountain States Pwr., com.	f 27	....	....
National Carbon	a124	120	130
National Carbon, pf.	a 94½	....	....
National Elec. Pwr., pf.	a 94½	94	96½
National Lt., Ht. & Pwr., 5% pf.	72	40	72
National Lt., Ht. & Pwr., com.—no par	25	11	30
National Pwr. & Lt., pf., $7—no par	100½	95	99
National Pwr. & Lt., com.—no par	412	185	423
National Pub. Serv., 7% pf.	f 92	....	....
National Pub. Serv., pfc. pf.	f 98	....	....
National Pub. Serv., A com.—no par	f 24	....	....
National Pub. Serv., B com.—no par	f 15½	14	20
Nebraska Pwr., 7% pf.	k102½	98½	103½
Nevada-Calif. Elec., com.	f 43	31	50½
N. J. Pwr. & Lt., 7% pf.	104	92	102
New Orleans Pub. Serv., 7% pf.	99	94	102
New Orleans Pub. Serv., com.—no par	f 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	f106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par	f 63	60	73
Nizer Corp., A.—no par	f 82½	....	....
Nizer Corp., B.—no par	f 85	....	....
No. Amer., 6% pf.—50	f 49½	46½	50½
No. Amer., com.—50	f 73½	41½	75
No. Caro. Pub. Serv., pf.—$7—no par	90	90	96
No. N. Y. Utilities, 7% pf.	f101½	....	....
No. Ohio Pwr., com.	16½	5	19
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	76	68	78
No. Ont. Lt. & Pwr., com.	48	41	52
No. States Pwr., 7% pf.	99	95	100
No. States Pwr. com.	134	103	135½
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	92	85	95
Ohio Pub. Serv., 7% pf.	97½	97	100
Ohio River Edison, 7% pf.	97	93½	100½
Oklahoma Gas & Elec., pf.	f 93	....	....
Pacific Gas & Elec., 6% pf.	97	92	99
Pacific Gas & Elec., com.	f131½	102½	132½
Pacific Pwr. & Lt., 7% pf.	k 99	97½	101
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	c70½	60	71
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	96	91	10.
Penn-Ohio Pwr. & Lt., 8% pf.	102	101	110
Penn Pwr. & Lt.—$7—no par	k104	98½	106
Penn Pub. Serv., 7% pf.	96	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., com.	c165	126½	185
Phila. Co., pf.—50	f 49	45½	49
Phila. Co., com.	f 60½	51½	62½
Phila. Elec., com.	c 48½	37½	49½
Pittsburgh Utilities, pf.	f 14½	12½	17½
Portland Elec. Pwr., 7% pf.	98	95	99
Portland Elec. Pwr., 6% pf.	72	70	80
Portland Elec. Pwr., com.	40	40	53
Portland Ry., Lt. & Pwr., pf.	f 72	....	....
Portland Ry., Lt. & Pwr., com.	f 41	....	....
Pwr. Corp. of N. Y., 7% pf.	f110	96	112
Pwr. Corp. of N. Y., com—no par	70	15	89½
Pwr. Sec., pf.	20	20	55
Pwr. Sec., com.	15	8	30
Pub. Serv. of N. J., 7% pf.	103	99	105½
Pub. Serv. of N. J., 8% pf.	118	108½	119
Pub. Serv. of N. J. com—no par	f82½	82½	87½
Pub. Serv. of No. Ill., pf.	a 98½	92	100
Public Serv. of No. Ill., 7% pf.	a109	102	110½
Pub. Serv. of No. Ill., com.—no par	a125½	107½	128½
Pub. Serv. of No. Ill., com.	a126	118	128½
Pub. Serv. of Okla., 7% pf.	93	87	95
Pub. Serv. Elec. & Gas, 6% pf.	f 97½	92½	97½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	f 84	....	....
Puget Sound Pwr. & Lt., com.	48	49	61
Radio Corp. of Amer., pf.—50	f 47	45½	54
Radio Corp. of Amer., com.—no par	f 55½	48½	77½
Republic Ry. & Lt., pf.	85	70	85
Republic Ry. & Lt., com.	57	49	65
Rochester Gas & Elec., 5% pf.	95	80	98
Servel Corp., Class A	f 34½	....	....
Servel Corp., Class B—no par	50	35	56
Sierra Pacific Elec., com.	f 25	....	....
Sioux City Gas & Elec., 7% pf.	f 99	....	....
Southeastern Pwr. & Lt., 7% pf.	97	90	100
Southeastern Pwr. & Lt., com—no par	33½	28	34½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110½	105	107½
So. Calif. Edison, 6% pf.	97	90	95½
So. Calif. Edison, com.	136	102	149
Southern Cities Utilities, 7% pf.	83	77	100
Southern Cities Utilities, com.	55	30	71
Southern Pwr. & Lt. of Md., pf.	f107	....	....
Southern Pwr. & Lt. of Md., com.	f 32	....	....
Southwestern Pwr. & Lt., A	f 47	....	....
Southwestern Pwr. & Lt., B	f 22½	....	....
Southwestern Pwr. & Lt., 7% pf.	99	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	94	92	93
Standard Gas & Elec., 8% pf.	f 56	50½	56
Standard Gas & Elec., 7% pf.	100½	96	100
Standard Gas & Elec., com.—no par	f 59½	40½	61
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superheater, com.—No par	142	120	152
Tampa Elec., com.	f267	....	....
Tenn. Elec. Pwr., 6% pf.	85	80	85
Tenn. Elec. Pwr., 7% pf.	98	93	103
Tenn. Elec. Pwr., pf.—$6—no par	f80	72	84
Tenn. Elec. Pwr., com.—no par	f 65	....	....
Tex. Pwr. & Lt., 7% pf.	k101½	99½	103½
Tide Water Pwr., 8% pf.	k 98	....	....
Timken Roller Bearing, com.	f 58½	37½	59½
Toledo Edison, 8% pf.	112	109	114
Toledo Edison, 7% pf.	100½	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	85	82	85
United Gas & Elec., 6% pf.	91	80	94
United Gas & Elec., com.—no par	48	26	51½
United Gas & Elec. (N. J.), 5% pf.	62	55	65
United Gas Impr.—50	c108	79½	108
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par	92	83	99
United Lt. & Pwr., com., A—no par	151	42	166½
United Lt. & Pwr., com., B—no par	155	49	100
Utah Pwr. & Lt., 7% pf.	k 99	97½	101½
Utica Gas & Elec., 7% pf.	102	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	90	90	97
Utilities Pwr. & Lt., com. B—no par	17½	12	20
Vermont Hydro-Elec., 7% pf.	92	87	96
Virginia Pwr., 7% pf.	101	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	f145	64½	145
Wagner Elec., pf.	b 89	79	92
Wagner Elec., com.—no par	b 37	26½	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	f 91	....	....
West Penn., 7% pf.	f 96	94	100
West Penn. com.	f112	97	145
West Penn Pwr., pf.	f108½	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50	41	38	47
Western Elec., 7% pf.	f 83	110	117½
Western Pwr., 7% pf.	96	84	....
Western Pwr., com.—no par	87	74	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	f 20	....	....
Westinghouse Elec. & Mfg., com.—50	f 75	66½	84
Weston Elec. Instrument, Cl. A	27	19½	28½
Weston Elec. Instrument, com.	f 17½	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	j90	92	95
Wis. Pwr., Lt. & Rr., 7% pf.	85	85	90
Worthington Pump, pf. A	76	77	88
Worthington Pump, pf. B	f 63½	58	76½
Worthington Pump, com.	f 44½	35½	79½
Yadkin River Pwr., 7% pf.	k104	98	106
Yale & Towne, com.—25	65	62	70½

BONDS

Abitibi Pwr. & Paper	6s	1940	100½	98	101½
Adir. Elec. Pwr.	5s	1962	99½	97½	100½
Adir. Pwr. & Lt.	6s	1950	104½	102½	105½
Adir. Pwr. & Lt.	5s	1930	96	94	97½
Ala. Pwr.	5s	1946	98	96	100
Ala. Pwr.	5s	1951	95	92½	97½
Ala. Pwr.	6s	1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s	1962	105	86	105
Aluminum Co. of Amer.	7s	1933	106½	106½	107½
Amer. Bosch Magneto	8s	1936	j103	86	101
Amer. Gas & Elec.	5s	2007	91	90	93½
Amer. Gas & Elec.	6s	2014	97½	96½	98½
Amer. Pwr. & Lt.	6s	2016	96½	94	98
Amer. Pub. Serv.	6s	1942	98	94	99½
Amer. Wtr. Wks. & Elec.	5s	1934	95½	92½	98
Anaconda Copper	6s	1929	103	102½	104
Anaconda Copper	6s	1953	101	99½	102
Anaconda Copper	7s	1938	104½	99½	104½
Appalachian Pwr.	5s	1941	98	96	99½
Appalachian Pwr.	6s	2024	93	86½	94½
Appalachian Pwr.	7s	1936	105	105½	106½
Arizona Pwr.	6s	1933	100	97½	101½
Arizona Pwr.	6s	1947	95½	90	96
Ark. Central Pwr.	6s	1948	100½	98½	102½
Ark. Lt. & Pwr.	6s	1945	102½	100	104½
Ark. Lt. & Pwr.	6s	1954	98	92½	99½
Assoc. Gas & Elec.	6s	1965	93½	92	96
Assoc. Gas & Elec.	6½s	1954	101	94½	106
Binghamton Lt., Ht. & Pwr.	5s	1946	98	94½	98½
Birmingham Elec.	6s	1954	101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s	1954	87½	85	89½
Broad River Pwr.	6½s	1934	100½	99	102
Brooklyn Edison	5s	1949	101½	99½	103
Brooklyn Edison	6s	1930	103½	103½	106
Buffalo Gen. Elec. 1st	5s	1939	101½	100½	101½
Buffalo Gen. Elec. 1st & Ref.	5s	1939	100½	100	100½
Burlington Ry. & Lt.	5s	1932	94½	90	96
Butte Elec. & Pwr.	5s	1951	99½	99	100½
Calif. Gas & Elec.	5s	1937	100½	98	101½
Canadian Lt. & Pwr.	5s	1949	40	36	62
Canton Elec.	5s	1937	99	99	100½
Carolina Pwr. & Lt.	5s	1938	99½	98½	100½
Carolina Pwr. & Lt.	6s	1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s	1953	99½	98½	100½
Central Ark. Ry. & Lt.	5s	1928	98½	98½	100
Central Ga. Pwr.	5s	1938	95½	93	97
Central Ill. Lt.	5s	1943	98½	94	99½
Central Ill. Publ Serv.	5s	1952	90	84½	92½
Central Ill. Pub. Serv.	6s	1944	99½	96½	101½
Central Ind. Pwr.	6s	1947	98½	95½	99
Central Ia. Pwr. & Lt.	6s	1944	99	97	100½
Central N. Y. Gas & El.	5s	1941	95	94	97½
Central Pwr. & Lt.	6s	1946	100½	97½	101½
Central Pwr. & Lt.	6½s	1952	101½	94	102
Central States Elec.	5s	1926	99	98	100½
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	102	98½	104½
Cincinnati Gas & Elec.	5½s	1967	103½	100½	105
Cities Service	6s	1966	90½	90	91½
Cities Service	7sB	1966	f175	....	....
Cities Service	7sC	1966	125½	111	128
Cities Service	7sD	1966	101½	98½	106½
Cities Service	7s	E1966	112½	112	112½
Cities Service Pwr. & Lt.	6s	1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s	1952	84	74	85½
Cleveland Elec. Illum.	5s	1939	101½	100	102
Cleveland Elec. Illum.	5s	1954	100½	97½	101
Cleveland Elec. Illum.	7s	1941	110	109	111½
Colorado Pwr.	5s	1953	96	93	96½
Columbia Gas & Elec.	5s	1927	99½	99½	100½
Columbia Ry., Gas & El.	5s	1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s	1037	85	83	88
Columbus, Dela. & Marion Elec.	6s	1937	95	91	98
Columbus Elec. & Pwr.	6s	1947	f102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s	1941	103	101½	105
Commonwealth Edison	5s	1943	a102	99½	102½
Commonwealth Edison	5s	1953	99½	98½	101
Commonwealth Edison	5s	1954	99½	98	101
Commonwealth Pwr.	6s	1947	102½	97½	103½
Community Pwr. & Lt.	6s	1950	96	94½	98
Conn. Ry. & Ltg.	4½s	1951	89½	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s	1962	80½	75½	82½
Consol. Elec.	5s	1955	96½	94	98½
Consol. Gas of N. Y.	5½s	1945	103½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935	97	95½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	106½	104½	108
Con. Gas, Elec. Lt. & Pwr.	5½s	1952	103½	101½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965	99½	98	100½
Consumers Elec. Lt. & Pwr.	5s	1936	94	93	96½
Consumers Pwr.	5s	1936	100	99	100½
Consumers Pwr.	5s	1952	96½	90½	100
Consumers Pwr.	5½s	1954	102½	99	104½
Continental Gas & Elec.	5s	1927	99½	99½	100½
Continental Gas & Elec.	6s	1947	99½	98	101
Continental Gas & Elec.	6½s	1964	98	96½	101
Continental Gas & Elec.	7s	1954	104	99	103½
Cumberland County Pwr. & Lt.	5s	1942	94½	92	96½
Dallas Pwr. & Lt.	6s	1949	104½	103	105½
Dayton Ltg.	5s	1937	99½	98½	100½
Dayton Pwr. & Lt.	5s	1941	99	97	100½
Defiance Gas & Elec.	5s	1942	95	88½	97½
Denver Gas & Elec.	5s	1949	97½	97½	100
Denver Gas & Elec. Lt.	5s	1951	93	92	95½
Des Moines Elec.	5s	1938	98	98	100½
Detroit Edison	5s	1933	102	99½	102½
Detroit Edison	5s	1940	102½	99½	102½
Detroit Edison	5s	1949	99½	97½	101½
Detroit Edison	5s	1955	99½	97½	100
Detroit Edison	6s	1932	145	110½	155
Detroit Edison	6s	1940	107½	106½	108½
Detroit Edison	7s	1928	j150½	125	156½
Detroit Edison	7s	1929	j150½	114	150½
Detroit Edison	7s	1930	145	121½	158½
Dominion Pwr. & Trans.	5s	1932	95	95½	98½
Driver-Harris	8s	1931	94	88	97
Dubuque Elec.	6s	1942	101	97½	102
Duke-Price Pwr.	6s	1949	101	98½	103
Duquesne Lt.	5s	1949	105	104	107½
Duquesne Lt.	5½s	1949	105	104	106
Durham Pub. Serv.	7s	1949	100	97½	101½
East Penn. Elec.	6s	1953	104½	100½	105½
East. Oregon Lt. & Pwr.	6s	1929	100	97½	100½
East. Tex. Elec.	5s	1942	f 94½	....	....
Economy Lt. & Pwr.	5s	1956	98	96	99½
Edison Elec. Illum. of Bkln.	4s	1939	92	89	95½
Edison Elec. Illum. (N. Y.)	5s	1995	101½	99½	103
El Paso Elec.	5s	1932	f102	....	....
El Paso Elec.	5s	1950	f 95½	....	....
Elec. Pwr. Corp. (Germany)	6½s	1950	87½	86½	88½
Elmira Wtr., Lt. & R.R.	5s	1956	95	92½	96½
Empire Dist. Elec.	5s	1949	91	86½	91½
Erie Ltg.	5s	1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s	1932	98½	96	100
Federal Lt. & Trac.	5s	1942	92	88	101½
Federal Lt. & Trac.	6s	1942	f01½	96½	103
Federal Lt. & Trac.	6s	1954	92½	91½	94½
Ft. Smith Lt. & Trac.	5s	1936	72	76½	82½
Ft. Worth Pwr & Lt.	5s	1931	99	99	100½
Galveston Elec.	5s	1940	91	86½	93½
General Elec.	3½s	1942	87½	83	90½
General Elec.	5s	1952	f107½	101½	107½
Georgia Carolina Pwr.	5s	1952	85½	82	90
Ga. Lt., Pwr. & Rys.	5s	1941	87½	86½	90½
Ga. Ry. & Elec.	5s	1932	98	98½	100½
Ga. Ry. & Elec.	5s	1949	92	88	94½
Ga. Ry. & Pwr.	5s	1954	91½	89½	96
Ga. Ry. & Pwr.	6s	1947	102	100½	103½
Ga. Ry. & Pwr.	7s	1941	104½	105	107
German Gen. Elec.	7s	1945	95½	92	96
Great Cons. Elec. Pwr. (Japan)	6½	1950	86	86	86½
Great Cons. Elec. Pwr. (Japan)	7s	1944	81	87½	91½
Great Falls Pwr.	5s	1940	102½	99½	102½
Great Northern Pwr.	5s	1935	98½	96	99
Great Western Pwr.	5s	1946	98½	95	99½
Great Western Pwr.	5½s	1955	98	96	99
Great Western Pwr.	6s	1949	100½	100	102½
Great Western Pwr.	6s	1952	101	99½	102½
Havana Elec. Ry., Lt. & Pwr.	5s	1954	92½	85½	95½
Holtwood Pwr.	6s	1954	103	100	104½
Houston Ltg. & Pwr.	5s	1931	99½	98½	100
Houston Ltg. & Pwr.	5s	1953	92	90½	95½
Houston Ltg. & Pwr.	5½s	1954	99½	97	101½
Hydraulic Pwr.	5s	1951	101	99½	102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal. gCincinnati; hSan Francisco. tBid, low, high, Monday, Nov. 2. jLatest quotations available. kBid, low, high, Wednesday, Nov. 4.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies			Bid Price Saturday, Oct. 31	Low 1925	High 1925
BONDS (Continued)					
Hydraulic Pwr.	5s	1950	101	100	103
Idaho Pwr.	5s	1947	96	93	97½
Ill. Elec. Pwr.	6s	1943	102	99½	103½
Ill. Pwr.	5s	1933	93½	93	95½
Ill. Pwr. & Lt.	6s	1953	100½	100½	102½
Ill. Pwr. & Lt.	7s	1953	102	99	102½
Ind. Elec.	6s	1947	98	97	99½
Ind. Gen. Serv.	5s	1948	95	92	97½
Ind. Lighting	4s	1958	80½	78	83
Indiana & Mich. Elec.	5s	1957	98½	97½	99½
Indiana & Mich. Elec.	5s	1955	95	95	98
Ind. Pwr.	7½s	1941	*j*105½	104	106
Ind. Service	5s	1950	89½	86½	92
Ind. Service	6s	2020	85	73	88½
Ingersoll-Rand	5s	1935	99½	99	99½
Interstate Elec.	6s	1933	95	95	99½
Interstate Pwr.	6s	1944	97½	95	99½
Interstate Pwr.	7s	1934	99½	97	100½
Interstate Pub. Serv.	6s	1948	98	96	100½
Iowa Ry. & Lt.	5s	1932	97½	97	99½
Jersey Cent. Pwr. & Lt.	5½s	1945	96	95	98
Kansas City Pwr. & Lt.	5s	1952	99½	95½	102
Kansas Elec. Pwr.	6s	1937	100	97½	102
Kansas Elec. Pwr.	6s	1943	100	97½	102
Kansas Gas & Elec.	6s	1952	101½	98½	103½
Kansas Gas & Elec.	6s	2022	91	86½	94½
Kentucky Utilities	6s	1949	100½	97	101½
Kings County Elec. Lt. & Pwr.	5s	1937	101½	99	103
Kings County Elec. Lt. & Pwr.	6s	1997	119	114½	120½
Kings County Ltg.	5s	1954	98½	89	101½
Kings County Ltg.	6½s	1954	106½	103½	108½
Knoxville Ry. & Lt.	5s	1946	92½	88	95½
Laclede Gas Lt.	5s	1934	100	98½	101½
Laclede Gas Lt.	5½s	1953	100½	95½	102
Laurentian Pwr.	6s	1936	100	96	100½
Laurentide Pwr.	6s	1936	*i*99	96	100
Laurentide Pwr.	5s	1946	99½	97	100½
Lehigh Pwr. Sec. (notes)	6s	1927	101	100½	101½
Lincoln Gas & Elec.	5s	1941	91	92½	95½
Long Island Ltg.	5s	1936	99½	98½	100½
Long Island Ltg.	6s	1954	100	99½	102
Long Island Ltg.	6s	1948	104	102	105½
Long Island Ltg.	6s	1954	100	99½	102
Los Angeles Gas & Elec.	5s	1939	98	98	101½
Los Angeles Gas & Elec.	5½	1943	98	94	99½
Los Angeles Gas & Elec.	5½s	1947	98	96	99½
Los Angeles Gas & Elec.	5½s	1949	97½	95½	99½
Louisiana Pwr.	6s	1942	102½	101½	104½
Louisiana Pwr.	6s	1944	97½	97	99
Louisville Gas & Elec.	5s	1952	96½	90½	99½
Louisville Gas & Elec.	5½s	1954	101½	99	102
Lower Austrian Hydro Elec.	6½s	1944	85½	85½	86½
Luzerne County Gas & Elec.	5s	1948	98	97	99½
Luzerne County Gas & Elec.	7s	1944	103	99½	104½
Luzerne County Gas & Elec.	6s	1954	102½	99	105
Madison River Pwr.	5s	1935	100	99½	101
Manila Elec.	7s	1942	101½	97½	102½
Manila Elec. Ry. & Ltg.	5s	1953	89	85	92
Manitoba Pwr.	7s	1941	104	98½	104½
Memphis Pwr. & Lt.	5s	1948	98½	95	99½
Metropolitan Edison	6s	1952	104	101½	106
Metropolitan Edison	5s	1953	96½	91½	97
Metropolitan Pwr.	6s	1953	103	100	104
Michigan Lt.	5s	1946	98	97½	100
Michigan No. Pwr.	5s	1941	96	95½	97
Milwaukee Elec. Ry. & Lt.	5s	1926	100	99½	101½
Milwaukee Elec. Ry. & Lt.	4½s	1931	96½	94½	97
Milwaukee Elec. Ry. & Lt.	5s	1951	97	94	100
Milwaukee Elec. Ry. & Lt.	5s	1961	89½	84½	92½
Milwaukee Elec. Ry. & Lt.	6s	1953	101	98½	104
Minn. Pwr. & Lt.	5s	1955	95	95	97
Minn. Pwr. & Lt.	6s	1950	103½	101½	105½
Miss. River Pwr.	5s	1951	98½	96½	100½
Miss. River Pwr.	7s	1935	102	102	104
Mo. Edison Elec.	5s	1927	*b*100	100	100½
Mobile Elec.	5s	1946	96	91	97½
Montana Pwr.	5s	1943	100½	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s	1943	*j*93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	98½	98½	101
Montreal Pub. Serv.	5s	1942	94½	89	94½
Mountain States Pwr.	6s	1938	98½	96½	100½
Nashville Ry. & Lt.	5s	1953	97	94	98
Nashville Ry. & Lt.	5s	1958	89½	84	88½
Nassau Lt. & Pwr.	5s	1927	99½	98	101
Nassau & Suffolk Ltg.	5s	1945	89	82	91
National Pwr. & Lt.	7s	1972	103½	97	104½
National Pub. Serv.	6½s	1955	94	94	96½
Nebraska Pwr.	5s	1949	99	97	99½
Nebraska Pwr.	6s	2022	96½	89½	96½
Nevada-Calif. Elec.	6s	1946	99	96½	100½
Nevada-Calif. Elec.	6s	1950	99	96½	100½
New England Pwr.	5s	1951	101	100½	103
New Jersey Pwr. & Lt.	5s	1936	95½	92½	97½
New Orleans Pub. Serv.	4½s	1935	85½	83½	88½
New Orleans Pub. Serv.	5s	1952	91½	90	92
New Orleans Pub. Serv.	5s	1955	91½	88½	92½
New Orleans Pub. Serv.	6s	1949	92	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s	1930	100	99½	101
N. Y. & Westchester Ltg.	4s	2004	78	76	81
N. Y. & Westchester Ltg.	5s	1954	96	93	97
New York Edison	6½s	1941	114½	112	115½
New York Edison	5s	1944	101	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s	1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s	1949	88½	86	90½
N. Y. State Gas & Elec.	5½s	1962	100½	96	101½
Newport News & Hampton Ry., Gas & Elec.	5s	1944	88	84	93
Niagara Falls Pwr.	5s	1932	102½	100	103
Niagara Falls Pwr.	6s	1932	106	103½	106½
Niagara Falls Pwr.	6s	1950	104½	105½	106½
Niagara, Lock. & Ont. Pwr.	5s	1954	*f* 98½	104½	110
Niagara, Lock. & Ont. Pwr.	5s	1955	98½	97½	100
Niagara, Lock. & Ont. Pwr.	6s	1958	*j*109½	104½	110½
Norfolk Ry. & Lt.	5s	1949	94	93	95½
No. Amer. Edison	6s	1952	101½	96½	102½
No. Amer. Edison	6½s	1948	103	100½	106
No. Amer. Lt. & Pwr.	7s	1954	99½	97	100
North Caro. Pub. Serv.	5s	1934	90	89	93½
North Caro. Pub. Serv.	6s	1954	94	91½	96
North Caro. Pub. Serv.	6½s	1944	98	96	100
North Shore Elec.	5s	1940	99	97½	100
No. Calif. Pwr.	5s	1948	99½	98½	100½
No. Ind. Gas & Elec.	5s	1929	99	97	100½
No. Ind. Gas & Elec.	6s	1952	102	99½	103½
Northern N. Y. Utilities	5½s	1949	99	96½	100½
No. Ohio Trac. & Lt.	4s	1933	85	82	87½
No. Ohio Trac. & Lt.	5s	1956	81	78	87
No. Ohio Trac. & Lt.	6s	1926	98½	98½	100
No. Ohio Trac. & Lt.	6s	1947	94	91	97
No. Ontario Lt. & Pwr.	6s	1931	98½	95½	99½
No. States Pwr.	6½s	1933	133	105½	133½
No. States Pwr. (notes)	6½s	1933	103	99½	104½
No. States Pwr.	6s	1948	102	101	104½
No. States Pwr.	6s	1941	104½	103	107½
No. States Pwr.	5s	1941	97½	93	99½
No. Tex. Elec.	5s	1940	65	80½	82½
Northwestern Elec.	6s	1935	101	101½	102½
Northwestern Pub. Serv.	6½s	1948	99	97½	100½
Ohio Pwr.	5s	1952	92	89½	96
Ohio Pwr.	6s	1953	102½	101	104½
Ohio Pwr.	6s	2024	95	88½	95½
Ohio Pwr.	7s	1951	106½	106½	107½
Ohio Pub. Serv.	5s	1954	91	87	93
Ohio Pub. Serv.	6s	1953	100½	98	101½
Ohio Pub. Serv.	7½s	1946	111½	108	112½
Ohio Pub. Serv.	7s	1947	110	107½	111½
Ohio River Edison	6s	1948	101½	98½	104
Okla. Gas & Elec.	5s	1950	91½	93½	96
Okla. Gas & Elec.	6s	1940	96½	96	98½
Ontario Pwr. of Niagara Falls	5s	1943	99½	98	100½
Ontario Transmission	5s	1945	99½	97	99½
Ozark Pwr. & Wtr.	5s	1952	76	75	81
Pacific Coast Pwr.	5s	1940	99	97½	99½
Pacific Gas & Elec.	5s	1942	97	93½	99
Pacific Gas & Elec.	5s	1955	*j*93½	94	95½
Pacific Gas & Elec.	5½s	1952	101	97½	102½
Pacific Gas & Elec.	6s	1941	105½	103½	106½
Pacific Lt. & Pwr.	5s	1951	99½	98½	100½
Pacific Lt. & Pwr.	5s	1942	99½	98	101½
Pacific Pwr. & Lt.	5s	1930	99½	98	100
Pacific Pwr. & Lt.	5s	1953	*j*96½	....	....
Parr Shoals Pwr.	5s	1952	94	92½	97
Paterson & Passaic Gas & Elec.	5s	1949	98½	96	100½
Penn Central Lt. & Pwr	6s	1953	103	102	104½
Penn Edison	5s	1946	96½	94	97
Penn Elec.	6½s	1954	98½	96	99½
Penn. Elec.	6s	1955	93½	93½	95
Penn Ohio Elec.	6½s	1938	104½	99½	105
Penn Ohio Pwr. & Lt.	5½s	1954	97½	95	99½
Penn Ohio Pwr. & Lt.	6s	1939	97½	94	99
Penn Pwr. & Lt.	5s	1952	97	95	98½
Penn Pwr. & Lt.	5s	1953	96½	95	98½
Penn Pwr. & Lt.	6s	1953	104½	102½	105½
Penn Pwr. & Lt.	7s	1951	105½	106	107½
Penn Pub. Serv.	5s	1954	95	93	96
Penn Pub. Serv.	6s	1947	103	103	105½
Penn Wtr. & Pwr.	5s	1940	101	99½	102
Penn Wtr. & Pwr.	5½s	1953	102	99½	103
Phila. Co.	6s	1944	103½	101½	105
Phila. Co.	5½s	1938	97½	93½	100
Phila. Co.	5s	1951	94½	95	97
Phila. Co.	5s	1949	*c*102	94½	104
Phila. Elec.	6s	1941	107½	104	108
Phila. Elec.	5s	1966	102½	100	104½
Phila. Elec.	5s	1960	*c*100½	100	104
Phila. Elec.	5½s	1947	*j*106½	103½	107
Phila. Elec.	5½s	1953	*c*106½	104½	107½
Portland Elec. Pwr.	6s	1947	99½	96½	100½
Portland Gen. Elec.	5s	1935	100	98½	100½
Portland Ry., Lt. & Pwr.	5s	1942	88½	84½	92
Portland Ry., Lt. & Pwr.	6s	1947	98½	94	100½
Portland Ry., Lt. & Pwr.	7½s	1946	105½	104½	108
Potomac Edison	6s	1949	98½	96	100
Potomac Edison	6½s	1948	102	99	103½
Potomac Elec. Pwr.	5s	1929	99½	99	100½
Potomac Elec. Pwr.	5s	1936	99½	98½	100
Power Corp. of N. Y.	6s	1942	99½	97½	101
Power Corp. of N. Y.	6½s	1942	104	99½	103½
Power Securities	6s	1949	*t*80	....	....
Pub. Lt. & Pwr.	5s	1945	70	64	79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92	96½
Pub. Serv. Co. of Colo.	6s	1953	99	98	101
Pub. Serv. Co. of Colo.	7s	1933	101	98½	102½
Pub. Serv. Corp. of N. J.	5s	1959	103	103½	105½
Pub. Serv. Corp. of N. J.	6s	1944	99½	95	100
Pub. Serv. Co. of No. Ill.	5s	1956	96	91	97½
Pub. Serv. Co. of No. Ill.	5½s	1962	101	96½	102½
Pub. Serv. Co. of No. Ill.	5½s	1964	101	96½	102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½	103
Pub. Serv. Elec. & Gas.	5½s	1959	103½	98½	105½
Pub. Serv. Elec. & Gas.	5½s	1964	103½	99½	105
Public Utilities (Evansville, Ind.)	6s	1929	99½	99	101
Puget Sound Pwr.	5s	1933	98½	98½	100½
Puget Sound Pwr. & Lt.	5½s	1949	99	96½	100½
Quebec Pwr.	6s	1953	101½	98½	102½
Queensborough Gas & Elec.	5s	1952	99½	96½	100½
Queensborough Gas & Elec.	6s	1953	104	101	105
Rio de Janeiro Tram., Lt. & Pwr.	5s	1935	92½	85	91½
Robbins & Myers	7s	1952	58	57½	73
Rochester Gas & Elec.	5½s	1948	103½	102	104½
Rochester Gas & Elec.	7s	1946	110½	109½	111
Rockford Elec.	5s	1939	99½	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s	1937	91	85½	92
St. Paul Gas Lt.	5s	1944	100½	98½	100½
St. Paul Gas Lt.	5½s	1954	101½	98	102½
Salt River Valley Wtr.	6s	1938	*t*100	....	....
Salmon River Pwr.	5s	1952	100½	98½	101½
San Antonio Gas & Elec.	5s	1949	97	96	98½
San Antonio Pub. Serv.	6s	1952	102	99½	104
San Diego Cons. Gas & Elec.	5s	1939	100½	98	101
San Diego Cons. Gas & Elec.	6s	1939	101½	99	103
San Joaquin Lt. & Pwr.	5s	1945	98½	98	100
San Joaquin Lt. & Pwr.	6s	1950	102½	101	103½
San Joaquin Lt. & Pwr.	6s	1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s	1954	100½	99	101
Savannah Elec. & Pwr.	7½s	1941	*t*104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945	93½	90½	94½
Scranton Electric	5s	1937	100½	99½	101½
Seattle Elec.	5s	1930	99½	99½	101
Seattle Elec.	5s	1929	99½	99	100½
Seattle Elec.	5s	1939	90½	90	93½
Seattle Ltg.	5s	1949	91	85½	92
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950	103½	101½	104
Shawinigan Wtr. & Pwr.	6s	1950	104½	104	106½
Siemens & Halske	7s	1928	97½	92½	99½
Siemens & Halske	7s	1935	94½	90½	96½
Sierra & San Francisco Pwr.	5s	1949	90½	90	95½
Sierra & San Francisco Pwr.	6s	1949	89	87	93½
Sioux City Gas & Elec.	6s	1947	101½	99	102
Sioux City Gas & Elec.	6s	1949	101½	99	102
So. Caro. Gas & Elec.	6s	1942	84	87	93
So. Caro. Gas & Elec.	6s	1932	75	83	88
Southeast Pwr. & Lt.	6s	2025	88	88	89
So. Cal. Edison	5s	1939	99½	99½	101
So. Cal. Edison	5s	1944	95	92½	96½
So. Cal. Edison	5½s	1944	101½	98½	102
So. Cal. Edison	6s	1943	101½	100½	104
So. Cal. Edison	6s	1944	104½	102½	105½
So. Cities Utilities	8s	1931	99	99	102
Southern Colo. Power	6s	1947	99½	93½	99½
So. Public Utilities	5s	1943	99½	97½	100½
So. Sierras Pwr.	6s	1936	102½	102	104½
So. Utilities	6s	1933	102	97½	102½
So. Wisconsin Pwr.	5s	1938	90	88	93
Southwestern Gas & Elec.	5s	1932	96½	94	98
Southwestern Gas & Elec.	6s	1957	96½	89	97½
Southwestern Pwr. & Lt.	5s	1943	94½	90	97
Southwestern Pwr. & Lt.	6s	2022	92	88½	94½
Southwestern Utilities	8s	1936	97	96	102
Springfield Ry. & Lt.	5s	1926	99½	98½	100½
Standard Elec. of Cal.	5s	1939	98½	98½	100½
Standard Gas & Elec.	6s	1935	99½	91	101
Staten Island Edison	6½s	1953	104½	103	106½
Syracuse Ltg.	5s	1951	90½	97½	100½
Syracuse Ltg.	5½s	1954	101½	100½	103
Tampa Elec.	5s	1933	*i*99	....	....
Tenn. Elec. Pwr.	6s	1947	102½	99½	104½
Tenn. Pwr.	5s	1962	94½	90	96½
Tex. Pwr. & Lt.	5s	1937	98	97	99½
Tex. Pwr. & Lt.	6s	2022	97	90	96½
Tide Water Pwr.	6s	1942	99½	98½	101
Tide Water Pwr.	7s	1937	98½	97½	101½
Toho Elec. Pwr. (Japan)	7s	1955	90	87	91½
Tokyo Elec. (Japan)	6s	1928	98½	98½	99½
Toledo Edison	5s	1947	98½	97	100
Toledo Edison	7s	1941	109½	108½	110
Toledo Gas Elec. & Htg.	5s	1935	96½	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	98	97½	100½
Topeka Edison	5s	1930	98½	97	100
Topeka Ry. & Lt.	5s	1933	95½	90½	96½
Trenton Gas & Elec.	5s	1949	98	98	100
Tri-City Ry. & Lt.	5s	1930	98½	96½	99½
Twin State Gas & Elec.	5s	1953	93½	84	94½
Tyr-l Hydro-Elec. Pwr.	7½	1955	97	94½	97
Union Elec. Lt. & Pwr.	5s	1932	100½	99½	102
Union Elec. Lt. & Pwr.	5s	1933	99½	98½	101
Union Elec. Lt. & Pwr.	5s	1954	98½	97½	100
Union Elec. Lt. & Pwr.	5½s	1954	101½	100	104
United Elec. of N. J.	4s	1949	87½	85	88½
United Elec. Lt. & Pwr.	4½s	1929	*j* 98½	98½	99
United Gas & Elec.	6s	1945	99	96	101
United Lt. & Pwr. notes	5½s	1928	99½	98	100
United Lt. & Pwr.	5½s	1959	93½	89½	97
United Lt. & Pwr.	6½s	1974	95	92½	97½
United Lt. & Rys.	5s	1932	95½	93½	97½
United Lt. & Rys.	6s	1926	99½	100½	101½
United Lt. & Rys.	6s	1952	98½	95½	100½
United Lt. & Rys.	6s	1973	89	87	92
United Pwr. & Lt.	6s	1944	101½	99	103
Utah Lt. & Trac.	5s	1944	87½	83½	91½
Utah Pwr. & Lt.	5s	1944	94½	91	98½
Utah Pwr. & Lt.	6s	1944	102½	102	104½
Utah Pwr. & Lt.	6s	2022	92½	88½	94½
Utica Elec. Lt. & Pwr.	5s	1950	101½	100½	102
Utica Gas & Elec.	5s	1957	100½	98½	103
Vermont Hydro-Elec.	6s	1929	100½	98½	100½
Vicksburg Lt. & Trac.	5s	1932	91	89	93½
Virginian Pwr.	5s	1942	93½	88	96
Virginian Pwr.	6½s	1954	101½	99	102½
Virginia Ry. & Pwr.	5s	1943	97½	93½	99
Wagner Elec. Mfg.	7s	....	*j*101½	100	102
Washington Coast Util.	6s	1941	101½	99½	101½
Washington Wtr. Pwr.	5s	1939	100½	99½	101½
West Penn Pwr.	5s	1963	93½	93½	99½
West Penn Pwr.	5s	1946	99½	93½	100
West Penn Pwr.	5½s	1953	103½	100½	105½
West Penn Pwr.	7s	1946	106½	104½	107½
West Virginia Lt., Ht. & Pwr.	6s	1929	100	95	100
West Virginia Utilities	6s	1935	95½	91	98
Westchester Ltg.	5s	1950	101½	98	102
Western Elec.	5s	1944	100½	98	101½
Western N. Y. Utilities	5s	1946	96½	90½	97½
Western Pwr.	6½s	*i*954	100	97	100½
West. States Gas & Elec.	5s	1941	97½	95	99½
West. States Gas & Elec.	6s	1947	99	97	100½
Westinghouse Elec. & Mfg.	7s	1931	106½	105½	108½
Wisconsin Elec. Pwr.	5s	1954	98½	93½	99½
Wisconsin Gas & Elec.	5s	1952	99	97	100½
Wis.-Minn. Lt. & Pwr.	5s	1944	95½	93	96½
Wis. Ry., Lt. & Pwr.	5s	1933	92½	87½	93½
Wis. River Pwr.	5s	1941	90½	88	92½
Yadkin River Pwr.	5s	1941	98	96½	99½
Yarmouth Lt. & Pwr.	5s	1937	83	82	87
Yarmouth Lt. & Pwr.	8s	1951	98	97	102

Stock Exchange: *c*Chicago; *b*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal. *g*Cincinnati; *h*San Francisco. *t*Bid, low, high, Monday, Nov. 2. *j*Latest quotations available. *k*Bid, low, high, Wednesday, Nov. 4.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Industry on the Atlantic Coast

THE states which border on the Atlantic Ocean from New York to Florida present an almost complete composite picture of American industrial, civic and home life. In these twelve states will be found the nation's and the world's chief financial center, some of the country's largest cities, one-third of the country's population, over one-third of the nation's industrial power, a large portion of the country's mining and 15 per cent of the agricultural land.

It is one of the fastest-growing sections of the country today. This is not only true of the Middle Atlantic States, but it is also true of the South Atlantic States. The South is awake to her opportunities in industry, and the next ten years should witness a complete change in the economic and industrial complexion of this section of the nation.

It is but natural that the electric light and power industry should play a large part in the development of these two sections. The first central station in the nation was established in New York City, and today this section consumes considerably more than one-quarter of the central-station energy and close to one-third of all the energy generated in the country by all plants, public and private. And yet the industries of the Middle Atlantic States are only 59.6 per cent electrified, and the domestic field is still fertile ground ready for more extensive development.

The Southern States have been slower to develop their industries, but the fact that today the manufacturing industries of this section are 56.8 per cent electrified would indicate that the central station has progressed rapidly in the development of the industrial power load.

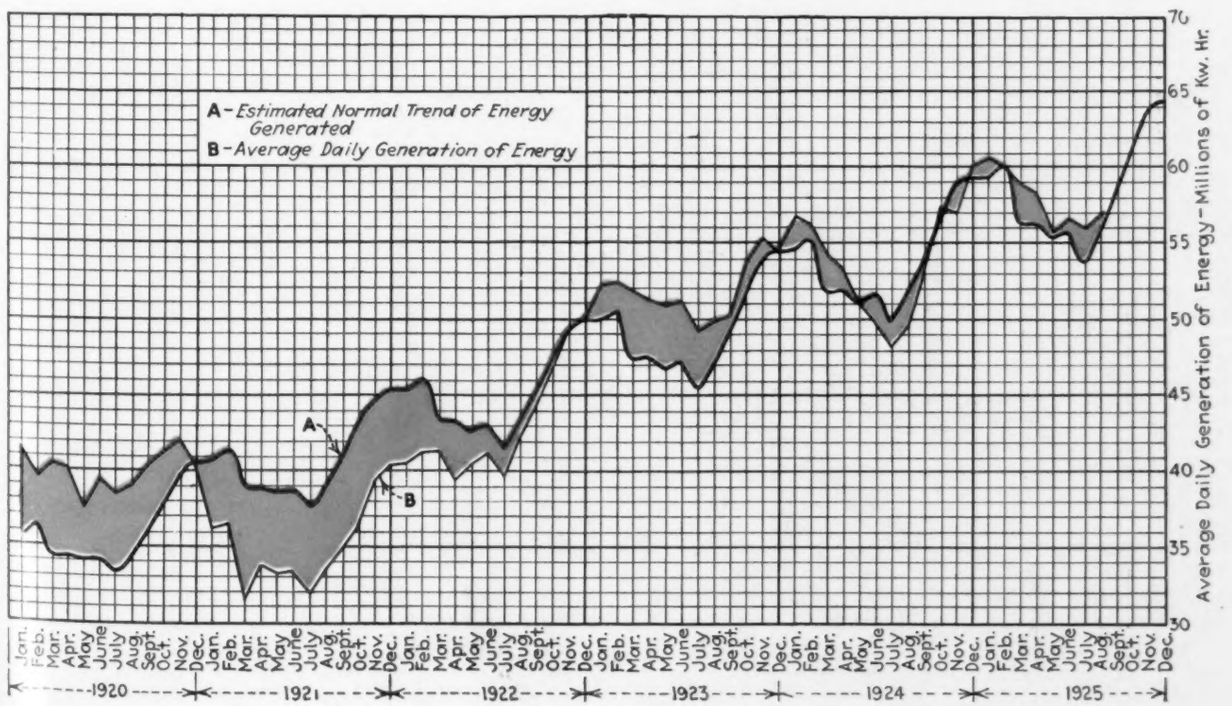
During the past six years the energy generated by central stations in these twelve Atlantic States has increased from 14,180,567,000 kw.-hr. to 21,323,000,000 kw.-hr., gross revenue from $312,760,000 to $550,000,000, value of plant and equipment from $1,217,000,000 to $2,162,000,000, number of customers from 2,884,000 to 5,500,000, rating of installed generators from 5,570,000 kva. to 8,790,000 kva., and during this period the industry has spent a total of $960,000,000 for additions and extensions to its generation, transmission and distribution systems.

During 1925 the central-station companies serving these two sections have been operating slightly above the average for the past five years. There is every reason to believe that this rate of growth will be maintained during the coming year.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Energy Generated by Central Stations of the Middle and South Atlantic States

(100 per Cent of the Industry)



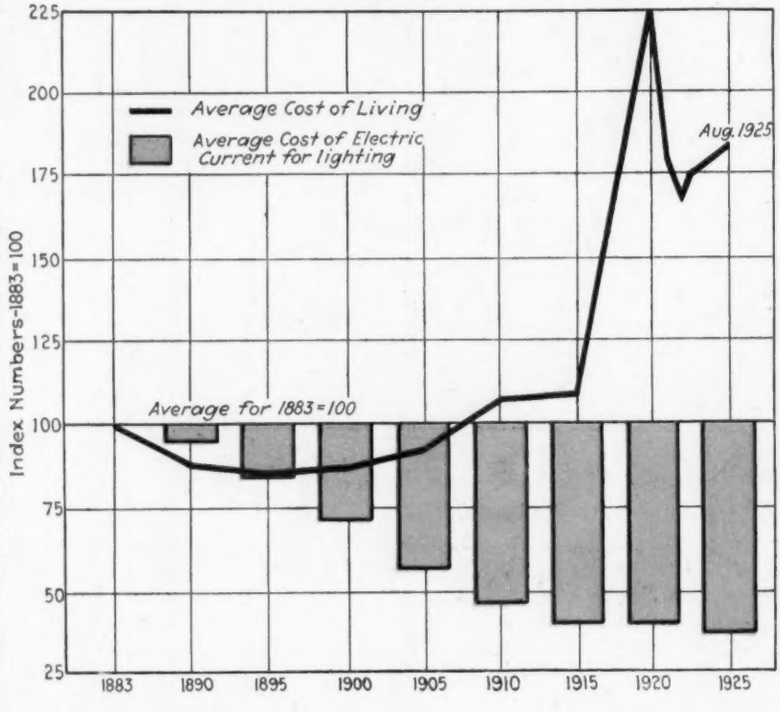
Cost of Lighting Versus Cost of Living

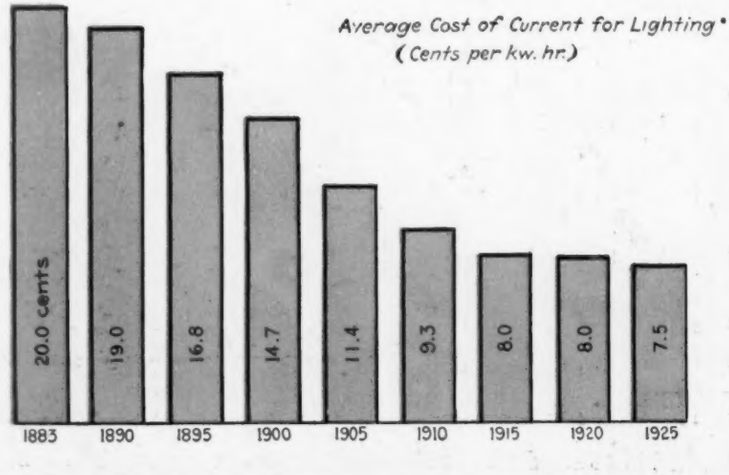
ONE of the basic factors leading to success and achievement is the ability to rise above the average level, to produce while others are idle or retrenching, to increase efficiency and at the same time decrease costs while the general tendency is toward higher costs. Such a quality must inevitably lead to success in its highest and truest sense.

The electrical industry is the personification of improved methods and decreased costs, both to the operating company and to the ultimate consumer. Few industries have utilized inventive genius and scientific thought more effectively than this great public utility. As a result, the electric light and power industry has been able to implant in the public mind the very important fact that it is an industry operating in the interest of the public, rendering an increasing service at a decreasing price and winning thereby that greatest of all business assets—public good will.

The closest contact between the electric light and power industry and the general public is through the lighting of the home. Electric lights are as much a part of the modern home as are the bathtub and running water. It is a contact which is renewed each month through the rendering and payment of the electric light and power bill. And the fact that this lighting bill has not risen per unit consumed as have the meat, grocery, coal and clothing bills has resulted in the lighting company attaining a favored position in the public mind.

The American Home Has Enjoyed a Continual Decrease in Cost of Electric Lighting, While the Cost of Living Has More than Doubled





The history of the cost of electrical energy for lighting purposes is but the story of the phenomenal progress made by the industry since its founding in 1882. It is a story of an almost continual decrease in lighting rates and increased efficiency in illumination. Back in 1883 the average cost of electrical energy for lighting purposes was 20 cents per kilowatt-hour; today it is 7.5 cents. This decrease in the cost of energy is all the more apparent when brought into comparison with the average cost of living since 1883. For the first ten years the index of cost of lighting as compared with 1883 costs was above the cost of living. Subsequent to that period, however, the cost of lighting has been more and more below the 1883 index, while the cost of living has been more and more above the 1883 index, reaching its maximum in 1920 and 1921. Today the cost of electricity for lighting purposes is 62.5 per cent below the 1883 cost and still on the downward grade, while the cost of living is approximately 85 per cent above that of 1883 and apparently on the up grade.

The increased electrical purchasing power of the dollar is even more outstanding. In 1888, with a 16-cp. carbon lamp at the efficiency and list price then prevailing and with an assumed rate of 13 cents per kilowatt-hour, 143 lumen-hours could be obtained for one cent, this being equivalent to about 1,400 candle-hours for one dollar. In 1922, with the 40-watt "Mazda" lamp, 1,690 lumen-hours could be had for one cent, which is equivalent to about 16,500 candle-hours for one dollar. The efficiency of the 40-watt "Mazda" lamp is now about 1 per cent better than in 1922, and it is estimated that the price for energy is about 5 per cent less; thus the amount of light obtainable today for a given expenditure is approximately 6 per cent above that of 1922.

Therefore, through the inventive genius and efficient operation of the electrical industry as a whole, the American home is today the best lighted and at the same time the most cheaply lighted home in the world. Not only is it the best lighted home in the world, but the low lighting rates have enabled the American common people to possess the same electrical conveniences to be found in the homes of the rich. The little cottage of today is a far more attractive place in which to live than were the great palaces of the feudal lords in the ages past. All of this would have been impossible had lighting rates remained as in 1883.